Report on Monitoring of Ambient Air Quality & Noise Levels at Bhopal during Diwali Festival-2020

November, 2020

CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE (CENTRAL)
BHOPAL

Central Pollution Control Board
Regional Directorate, Bhopal

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Introduction

Diwali also called as Deepawali is one of India's biggest festivals celebrated in the month of Kartikmas, between mid-October and mid-November. This festival of lights mark the return of Lord Rama after 14 years of exile and victory of good over evil symbolizing the elimination of darkness, that light empowers to commit ourselves to have good deeds closer to divinity. It is celebrated for five consecutive day's starts with Dhanteras followed by Chhoti Diwali and then main Diwali. "Diwali, a contraction of the word "Deepawali" meaning row of lights in Sanskrit is often celebrated with food, cracker bursting, parties and, of course, colourful lights hanging everywhere.

Background

Diwali, the spectacular Hindu festival of lights is celebrated all over the country. Traditionally, the houses are illuminated with earthen lamps or candles for the attainment of health, wealth, knowledge, peace, joy and prosperity. But presently burning of firecrackers is the highlight of Diwali. Fireworks produce colourful lights and various levels of sounds which lead to several short and long term impacts on the environment, humans, plant and animals. The noise triggers hearing loss, sleep disturbance, hypertension, high stress levels etc. Fireworks are mainly composed of toxic chemicals like lead, barium, chromium etc., and these chemicals and gases like carbon monoxide, nitrogen and Sulphur oxides are released during

bursting of fireworks having many adverse impacts.

To minimize the pollution levels by bursting of the fireworks and its associated adverse health impacts during the Diwali CPCB has taken initiatives to create public awareness towards adverse health & environment impacts of crackers bursting and is monitoring ambient air and noise levels during Diwali festival.

Objectives

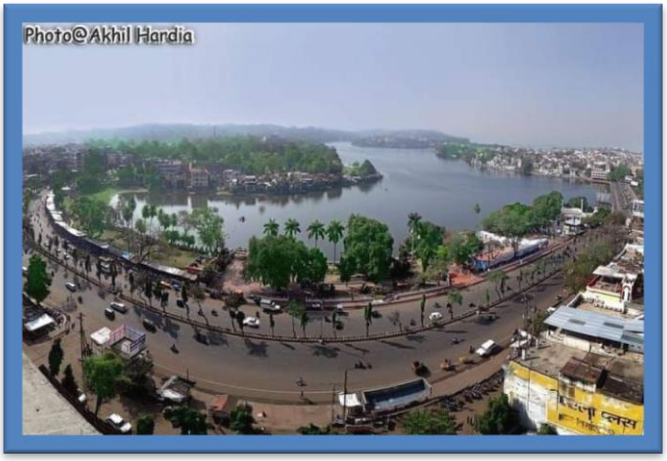
With reference to received CPCB Head Office Letter No. A-21016/1/08-Mon/7662 dated 17.09.2020, Regional Directorate (Central), Central Pollution Control Board, Bhopal has carried out short-term Ambient Air Quality & Noise monitoring for 15 days commencing from 7 days prior to Diwali and ending 7 days after Diwali in Bhopal city from 07.11.2020 to 21.11.2020 with the following objectives:

- **Noise monitoring** on pre-Diwali day i.e. 09.11.2020 (Monday) and Diwali day i.e. 14.11.2020 (Saturday).
- **Ambient Air Quality Monitoring** at two locations of the Bhopal city i.e. Sahkar Bhawan, North T.T. Nagar (Commercial) and Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar, Bhopal (Residential) for consecutive 15 days from 07.11.2020 to 21.11.2020 for general parameters PM_{10}, $PM_{2.5}$, SO_2, NO_2 and metals (Pb, Ni, As in PM_{10}) & (Al, Ba, Fe in $PM_{2.5}$).
- To create awareness among public about the ill-effects caused by the crackers and in general by pollution.

Bhopal City & Climate

Bhopal city capital of state Madhya Pradesh has population of 1,995,648 as per the census 2011 spread in the municipal area of 648.24 KM^2. It is situated in latitude of 23°15'N and longitude of 77°25'E. Bhopal city is one of the fast growing cities, where housing, infrastructure, transportation and industrialization in Mandideep industrial area, Govindpura industrial area under projects are in greater swing. This city is well known as 'City of lakes' because of the number of ponds and lakes. Bhopal has a humid subtropical climate, with cool, dry winters, a hot summer and a humid monsoon season. Summers start in late March and go on till mid-June, the average temperature being around 35°C, with peak of summer in May, when the highs

regularly exceeds 40°C. The monsoon starts in late June and ends in late September. The average temperature is around 28°C and the humidity is moderate. Temperatures rise again up to late October when winter starts, which lasts up to early March. Winters in Bhopal are cool, sunny and comfortable.



Ambient Noise and Air Quality Monitoring Locations

Central Pollution Control Board, Regional Directorate, Bhopal carried out ambient air quality monitoring before Diwali, on Diwali & post Diwali day from 07.11.2020 to 21.11.2020 and noise monitoring was carried out before Diwali on 09.11.2020 and on Diwali 14.11.2020 as per the protocol received from CPCB, Head Office at two locations in Bhopal city- i.e. Sahkar Bhawan, North T.T. Nagar (Commercial) and Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar, Bhopal (Residential).

Table 1: Diwali Monitoring Location Details

Name of the monitoring location	Zone	Latitude	Longitude	Activities around locations
Sahkar Bhawan, North T.T. Nagar, Bhopal	Commercial	23°14'138"N	77°23'891"E	Vehicle movement, commercial, Civil construction activities and bursting of crackers
Govt.Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar, Bhopal	Residential	23°12.968"N	77°23.579"E	Road sweeping, traffic movement, Bursting of crackers, common daily activities

The parameters monitored are Respirable Suspended Particulate Matter (PM_{10}), $PM_{2.5}$ and the gaseous pollutants are Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_x) and metals (Pb, Ni, As in PM_{10}) & (Al, Ba, Fe in $PM_{2.5}$). The Ambient Level Noise monitoring was performed pre-Diwali on 09.11.2020 and during

Diwali on 14.11.2020 for the parameters L_{eq}, L_{10}, L_{50}, L_{90}, L_{min}, and L_{max} with 1 sec sampling period. Ambient air quality monitored for 24 hours (6:00AM- 6:00AM) where as ambient noise levels monitored for 6 hours (6:00 PM-12:00 mid night).

Google Map showing the monitoring location

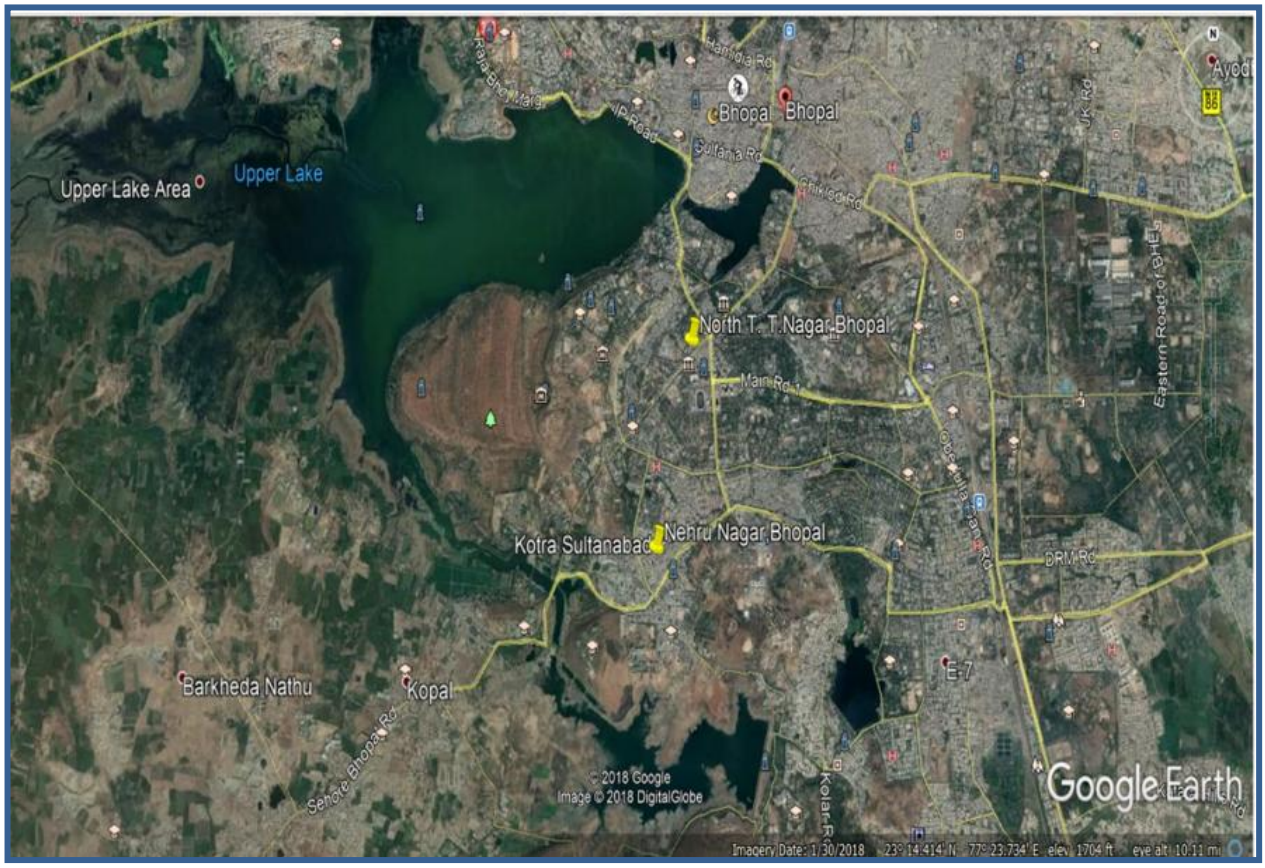


Table 2: Meteorological Data during Diwali Monitoring

Date	Temperature (°C)		Prominent Wind direction (deg.)	wind speed (M/S)	Humidity (%)
	Min.	Max.			
07.11.2020	**18.5**	**30.5**	**175**	**0.59**	**36**
08.11.2020	**18.5**	**29.7**	**175**	**0.56**	**38**
09.11.2020	**16.8**	**29.2**	**193**	**0.60**	**37**
10.11.2020	**17.3**	**28.3**	**198**	**0.70**	**35**
11.11.2020	**16.6**	**27.5**	**202**	**0.60**	**40**
12.10.2020	**16.7**	**29.4**	**187**	**0.90**	**54**
13.10.2020	**18.8**	**30.5**	**166**	**0.99**	**60**
14.10.2020	**28.2**	**32.3**	**140**	**0.72**	**61**
15.10.2020	**18.5**	**30.5**	**175**	**0.59**	**36**
16.10.2020	**19.8**	**30.4**	**187**	**0.69**	**62**
17.10.2020	**18.7**	**29.4**	**168**	**0.64**	**69**
18.10.2020	**19.6**	**30.1**	**185**	**0.89**	**66**
19.10.2020	**20.3**	**28.2**	**198**	**1.05**	**74**
20.10.2020	**16.9**	**24.7**	**165**	**1.33**	**72**
21.10.2020	**14.7**	**24.1**	**161**	**1.01**	**50**

Note: *Data generated by CPCB, RD-Bhopal*

During Diwali monitoring period no cloud cover and no rainfall were observed in the city.

RESULT AND DISCUSSION

PART-I Ambient Noise Level Monitoring

Ambient Noise level was measured using a Type 1 integrating sound level meter with free-field microphone which meets the Accuracy of noise certifying standards as per IEC 804 (BS 6698) Grade I or ANSI Type I or equivalent IEC 61672-1(2002-05) Class-I.

Ambient Noise Level monitoring was carried out pre-Diwali (09.11.2020) and during Diwali (14.11.2020) from (18:00hrs to 24:00 hrs) as per the prescribed protocol for L_{eq}, L_{10}, L_{50}, L_{90}, L_{min}, and L_{max} parameters at two locations namely Sahkar Bhawan, North T.T. Nagar (commercial) and Govt. Balak Ucchter Madhyamic Vidyalaya,

Kotra-Sultanabad, Nehru Nagar (Residential) manually. The average noise levels recorded both on pre-Diwali and during Diwali days are presented in Table- 3.

Table 3: Status of Ambient Noise Level measured manually in Bhopal pre-Diwali (09.11.2020) and during Diwali (14.11.2020) days from 18.00 hrs to 24.00 hrs

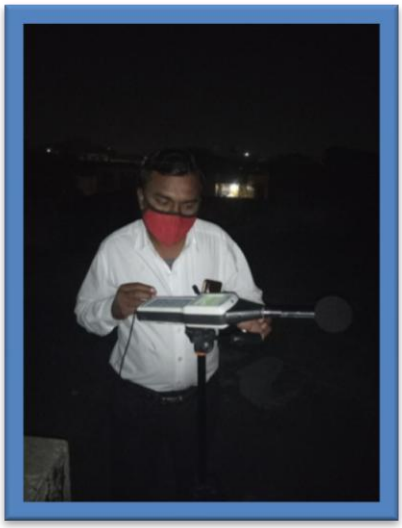
Location: Sahkar Bhawan, North T.T. Nagar (Commercial)	Pre-Deepawali Day (09.11.2020)			Deepawali Day (14.11.2020)		
Time duration	**Lmin**	**Lmax**	**Leq dB(A)**	**Lmin**	**Lmax**	**Leq dB(A)**
18:00 to 19:00 Hr	59.2	90.9	**64.8**	56.7	103.2	**77.3**
19:00 to 20:00 Hr	58.6	80.6	**64.2**	58.6	93.7	**73.2**
20:00 to 21:00 Hr	58.1	81.4	**62.4**	59.3	95.0	**74.3**
21:00 to 22:00 Hr	55.6	82.2	**62.9**	60.2	92.4	**72.7**
22:00 to 23:00 Hr	50.1	80.1	**62.7**	60.9	94.2	**73.7**
23:00 to 24:00 Hr	52.1	80.0	**58.7**	56.2	91.3	**67.9**

Location: Govt.Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar (Residential)	Pre-Deepawali Day (09.11.2020)			Deepawali Day (14.11.2020)		
Time duration	**Lmin**	**Lmax**	**Leq dB(A)**	**Lmin**	**Lmax**	**Leq dB(A)**
18:00 to 19:00 Hr	53.3	80.6	**58.9**	51.5	88.7	**63.2**
19:00 to 20:00 Hr	53.5	76.5	**58.8**	51.7	93.2	**70.3**
20:00 to 21:00 Hr	54.7	75.5	**59.5**	54.4	96.8	**76.3**
21:00 to 22:00 Hr	45.3	76.7	**58.0**	60.0	100.6	**82.0**
22:00 to 23:00 Hr	53.5	65.5	**57.5**	58.3	102.7	**80.1**
23:00 to 24:00 Hr	49.9	83.6	**58.7**	53.9	93.6	**73.1**

Interpretation of Noise Data/Results:

The noise level data measured at the 2 Locations- Sahkar Bhawan, North T.T. Nagar (commercial) and Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar (Residential) indicates that during Diwali period noise level at residential location of Nehru Nagar was found higher as compared to the commercial

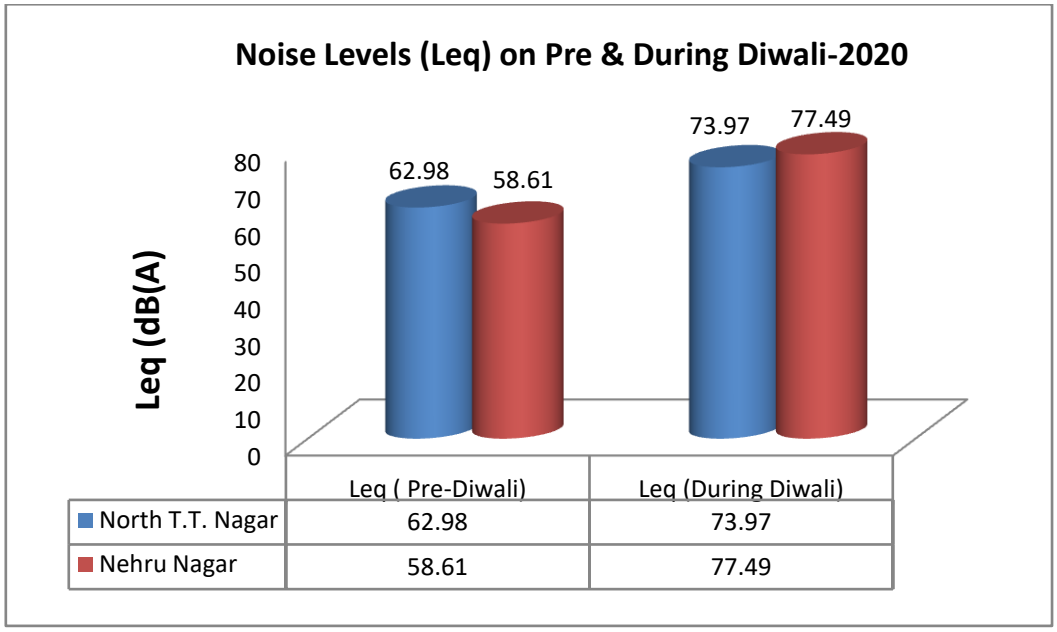
location of North T.T. Nagar. However, in pre-Diwali period the noise level at commercial location of North T.T. Nagar was higher than that of Residential area of Nehru Nagar. This represents heavy traffic and crowd in market place due to festive time.



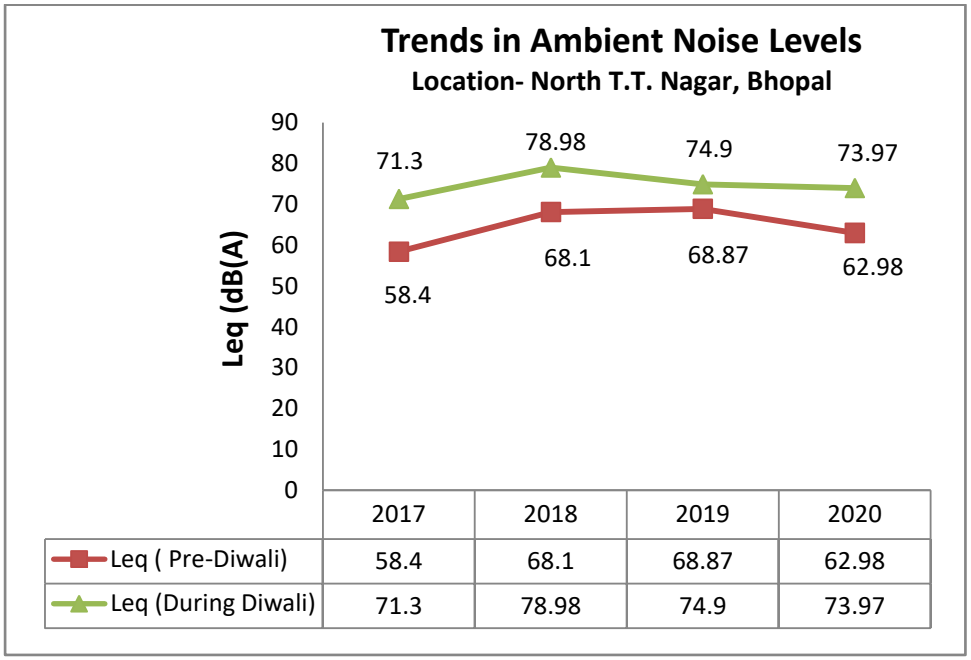
During Diwali the highest L_{eq} dB(A) level 82.0 dB(A) recorded at Nehru Nagar between 9 and 10 PM, followed by 80.1 d(B)A between 10 to 11 PM at the same location which are exceeding the standard limit of 45L_{eq} dB(A) prescribed for residential area for night time. The average L_{eq} dB(A) values observed at North T.T. Nagar and Nehru Nagar during pre-Diwali day was found 62.98 dB(A) and 58.61 dB(A) respectively and during Diwali day it was found 73.97 dB(A) and 77.49 dB(A) respectively.

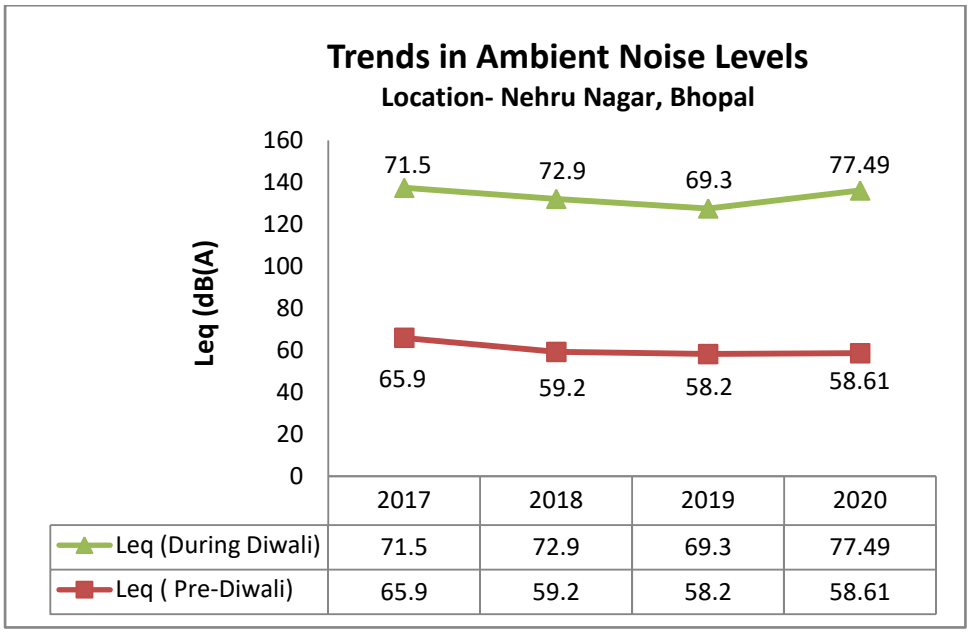
At North T.T. Nagar station both on pre-Diwali and Diwali day the noise level was monitored lower than the previous year (2019). However, at Nehru Nagar station no reasonable exceedance was monitored on pre-Diwali day but on Diwali day the percentage exceedance of 11.81 % was observed. The average L. equivalent levels of each location for both normal and Diwali days with respect to the standard limits are depicted in Graph-1.

Graph 1: Noise Levels (Leq) on Pre-Diwali & During Diwali- 2020



Graph 2: Trends in Noise Levels (Leq) on Pre-Diwali & During Diwali from 2017 to 2020





PART-II Ambient Air Quality Monitoring

Ambient air quality monitoring in Bhopal at selected locations during was carried out between 06:00 hrs to next day 06:00 hrs on 24 hourly bases for consecutive 15 days from 07.11.2020 to 21.11.2020. The parameters analysed and instruments &methods used for Diwali Monitoring are given in Table-4.

Table 4: Instruments and Methods used for Diwali Monitoring

Parameter	**Equipment used for**	**Method of Measurement**
Respirable Suspended Particulate Matter (PM10)	Respirable Dust Sampler - APM 460NL	Gravimetric method
Sulphur Dioxide (SO2)	Thermoelectrically cooled attachment or gas sampler	Improved West Geake method
Nitrogen Dioxide (NOx)		Modified Jacob & Hochheiser
PM 2.5	PM 2.5 sampler BGI make	Gravimetric method
Heavy metals in PM_{10} (As, Pb, Ni)	Respirable Dust Sampler - APM 460NL	AAS/ EDXRF/ ICP-MS/ ICP-AES
Metals/ Elements in $PM_{2.5}$ (Al, Ba, Fe)	PM 2.5 sampler BGI make	EDXRF/ ICP-MS/ ICP-AES

The results obtained for the monitored parameters pre-, on- and post-Diwali period are depicted in **Table 5** and **6**.

Table 5: Status of Ambient Air Quality at the Location- Sahkar Bhawan, North T.T. Nagar (Commercial)

Name of the location: **Sahkar Bhawan, North T.T. Nagar (Commercial)**										
Date	Regulatory Parameters							Proposed New Parameters		
	$SO_2(\mu g/m^3)$	$NO_2(\mu g/m^3)$	$PM_{10}(\mu g/m^3)$	$PM_{2.5}(\mu g/m^3)$	Metals in PM_{10}			Metals/Elements in $PM_{2.5}$		
					Pb (ng/m^3)	Ni (ng/m^3)	As (ng/m^3)	Al ($\mu g/m^3$)	Ba ($\mu g/m^3$)	Fe ($\mu g/m^3$)
07.11.2020	6.84	23.66	211	163	50	11	3	1.354565308	0.000248544	1.391846922
08.11.2020	7.26	27.08	202	156	79	20	3	1.080182501	0.050673645	0.785120773
09.11.2020	7.80	26.70	241	159	51	8	3	1.334995786	0.000251791	1.275573114
10.11.2020	7.23	28.71	266	172	503	8	4	0.864298793	0.000248648	0.749423637
11.11.2020	7.85	25.50	264	147	56	8	3	1.758975113	0.000270362	1.817914027
12.11.2020	9.34	40.54	177	99	33	7	1	0.726343621	0.126384774	0.545372428
13.11.2020	9.72	41.35	191	84	37	21	1	0.912039118	0.085037453	0.691737412
14.11.2020 (Diwali)	**14.15**	**56.35**	**294**	**167**	**292**	**10**	**3**	**12.40018148**	**7.927282019**	**0.731357947**
15.11.2020	11.59	22.39	97	42	45	12	1	1.330761548	0.555975864	0.442095298
16.11.2020	8.28	23.89	130	64	82	8	3	1.079082015	0.436806828	0.526357202
17.11.2020	8.52	21.37	118	60	44	4	1	1.057689425	0.075122814	0.978586595
18.11.2020	8.76	33.15	121	65	49	7	3	0.457014149	0.055697045	0.356560549
19.11.2020	8.43	26.59	116	64	36	7	3	0.178031627	0.019891802	0.243674573
20.11.2020	5.74	23.09	127	52	50	6	3	0.424192676	0.069621307	0.374463171
21.11.2020	8.65	23.18	102	48	373	9	3	0.408776529	0.076583437	0.432149397

Table 6: Status of Ambient Air Quality at the Location- Govt.Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar, Bhopal

Name of the location: **Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar, Bhopal**										
Date	Regulatory Parameters							Proposed New Parameters		
	$SO_2(\mu g/m^3)$	$NO_2(\mu g/m^3)$	$PM_{10}(\mu g/m^3)$	$PM_{2.5}(\mu g/m^3)$	Metals in PM_{10}			Metals/Elements in $PM_{2.5}$		
					Pb (ng/m^3)	Ni (ng/m^3)	As (ng/m^3)	Al ($\mu g/m^3$)	Ba ($\mu g/m^3$)	Fe ($\mu g/m^3$)
07.11.2020	5.07	23.98	200	144	66	97	3	1.006972956	0.002203442	1.004769514
08.11.2020	5.65	25.34	199	156	195	29	3	1.059829086	0.000371349	0.948424487
09.11.2020	5.00	26.72	186	158	52	129	3	1.044100765	0.000381059	0.940452806
10.11.2020	6.27	24.11	246	169	154	105	4	1.465566038	0.058741311	1.134478649
11.11.2020	5.89	33.89	212	171	60	17	3	1.497680921	0.327052632	0.789328947
12.11.2020	7.23	33.91	183	111	43	49	3	1.948909631	0.772161646	0.839592703
13.11.2020	6.85	40.84	120	88	40	42	4	1.718930948	0.69890599	0.714315724
14.11.2020 (Diwali)	**15.00**	**47.32**	**477**	**345**	**1273**	**39**	**12**	**32.6568685**	**39.66872867**	**2.251254682**
15.11.2020	9.96	21.37	117	51	102	19	1	3.205721714	1.820834027	0.594517471
16.11.2020	5.33	20.81	169	90	144	23	3	3.868955472	2.105547233	0.654440283
17.11.2020	5.43	18.46	140	94	61	10	1	1.597149105	0.804795918	0.647022074
18.11.2020	5.59	31.94	119	76	61	19	1	0.420214315	0.141231794	0.292409488
19.11.2020	5.69	26.69	122	73	37	15	1	0.343917118	0.025383174	0.254329446
20.11.2020	5.74	23.46	132	95	64	11	3	0.686055371	0.261686095	0.43979184
21.11.2020	6.75	23.10	158	85	216	33	1	0.606707622	0.192613494	0.357852978

Interpretation of Ambient Air Quality Data/ Results:

Particulate Matter (PM_{10})

During the entire monitoring period from 9 to 21.11.2020, PM_{10} values were detected higher than the prescribed standard limit 100 µg/m^3 for 24 hrs.

During pre-Diwali period from 9.11.2020 to 13.11.2020 PM_{10} values were detected in the range of 177 to 266µg/m^3 at Sahkar Bhawan, North T.T. Nagar and 120 to 246µg/m^3 at Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar respectively.

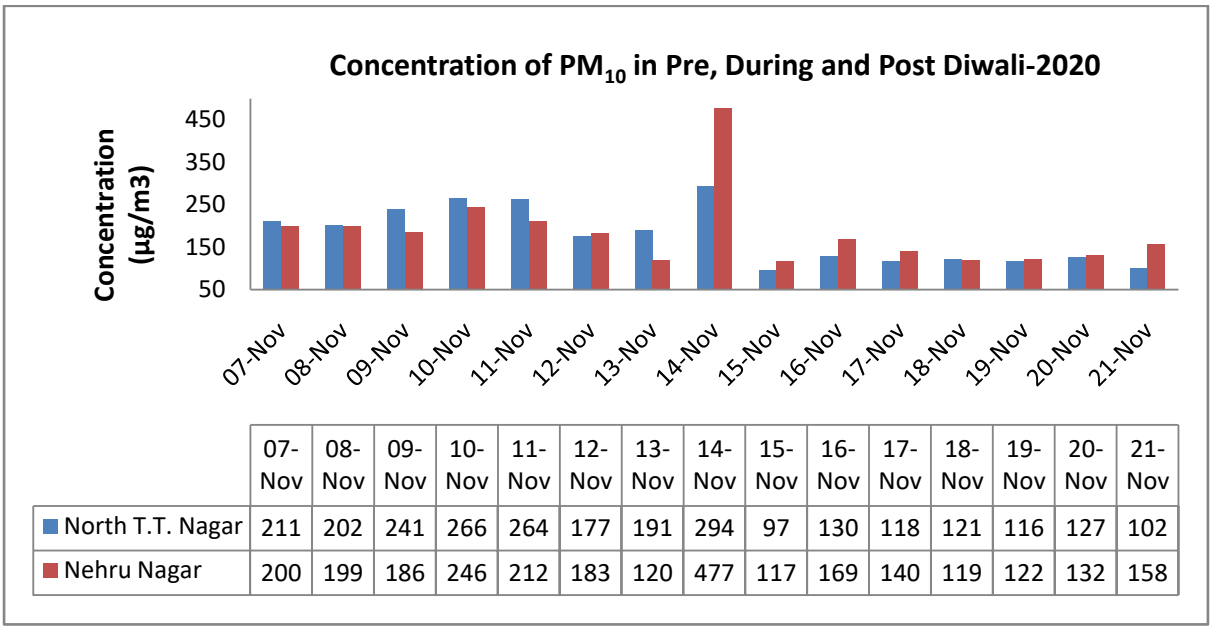
During Diwali on 14.11.2020 the PM_{10} was detected 294µg/m^3 at North T.T Nagar and 477µg/m^3 at Nehru Nagar.

However, during post Diwali period slight decrease in PM_{10} values was observed at both the locations. The average PM_{10} concentrations are shown below in the **Graph 3**.

The average concentration of PM_{10} was observed much higher this year on Diwali Day (14.11.2020) as compared to the last year Diwali Day (27.10.2019) on both the locations. The concentration was detected at North T.T. Nagar on Diwali Day (2020) i.e. 294 µg/m^3 and at Nehru Nagar i.e. 477 µg/m^3 as compared to last year 2019 i.e. 144 µg/m^3 and 156 µg/m^3 respectively. The level of PM_{10} found in 2020 & 2019 are shown in **Graph 4**.

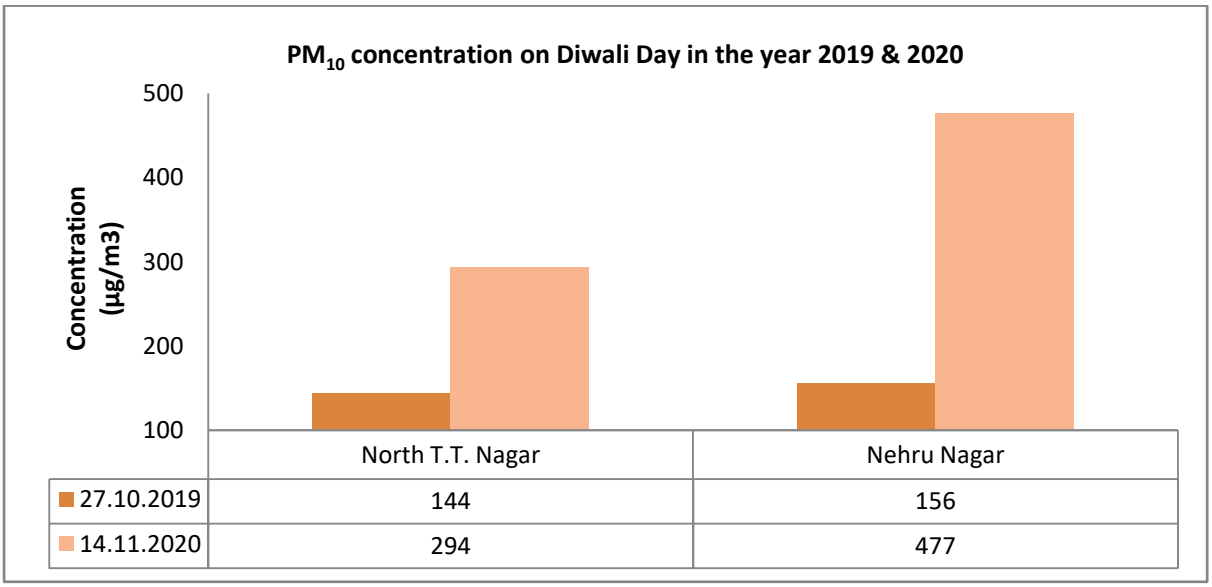
This exceedance in PM_{10} values are observed because the climate was much colder with frost this year, while last year 2019 frequent rainfalls were observed during the entire monitoring period. Also, near the monitoring point, some construction activities were observed under execution.

Graph 3: Concentration of PM_{10} in Pre, During and Post Diwali-2020



	07-Nov	08-Nov	09-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov
North T.T. Nagar	211	202	241	266	264	177	191	294	97	130	118	121	116	127	102
Nehru Nagar	200	199	186	246	212	183	120	477	117	169	140	119	122	132	158

Graph 4: PM_{10} concentration on Diwali Day in the year 2019 & 2020



Particulate Matter ($PM_{2.5}$)

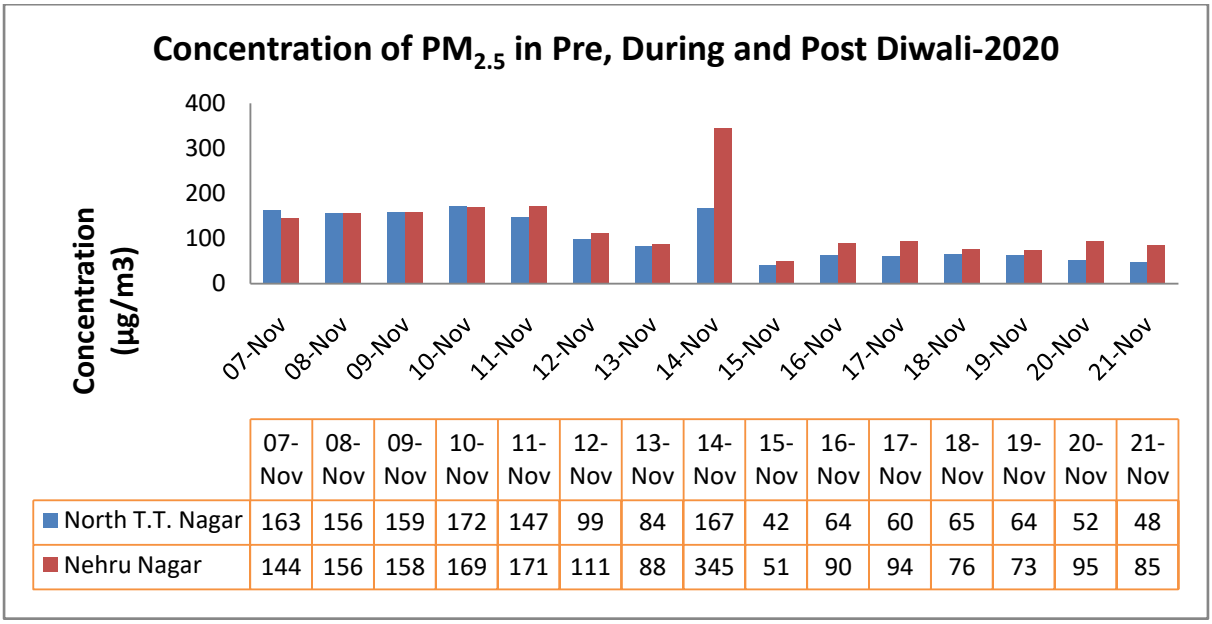
The concentration of $PM_{2.5}$ was detected higher than the prescribed standard limit 60µg/m^3 during the entire monitoring period of 15 days at the location Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar while exceeding total 11 days out of 15 monitoring days at Sahkar Bhawan, North T.T. Nagar. The average PM2.5 concentrations are shown below in the Graph 5.

During pre-Diwali period from 7.11.2020 to 13.11.2020 $PM_{2.5}$ values were detected in the range of 84 to 172µg/m^3 at North T.T. Nagar and 88 to 171µg/m^3 at Nehru Nagar respectively.

During Diwali on 14.11.2020 the $PM_{2.5}$ values were detected 167µg/m^3 at North T.T Nagar and 345µg/m^3 at Nehru Nagar. However, during post Diwali period decrease in $PM_{2.5}$ values was observed at both the locations.

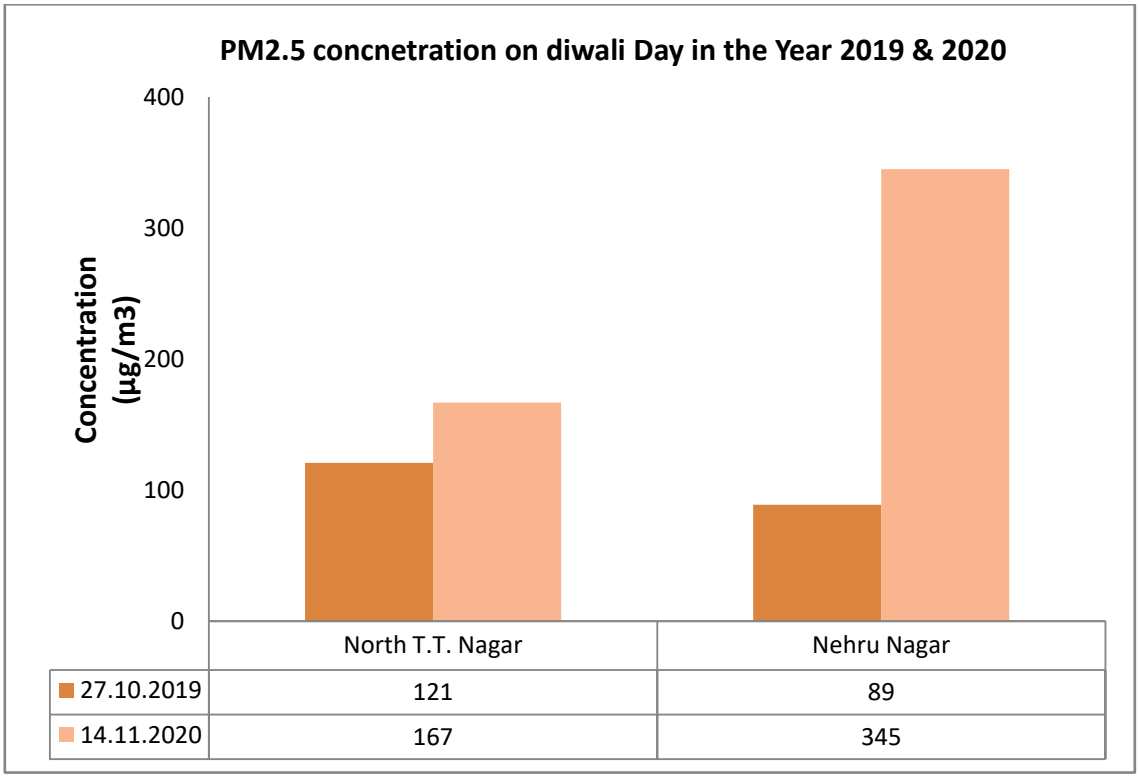
The average concentration of $PM_{2.5}$ was observed much higher this year on Diwali Day (14.11.2020) as compared to the last year Diwali Day (27.10.2019) on both the locations. The concentration was detected at North T.T. Nagar on Diwali Day (2019) i.e. 167 µg/m^3 and at Nehru Nagar i.e. 345 µg/m^3 as compared to last year 2019 i.e. 121 µg/m^3 and 89 µg/m^3 respectively. The level of $PM_{2.5}$ found in 2020 & 2019 are shown in **Graph 6**. This exceedance in the level of $PM_{2.5}$ was observed due to much colder conditions this year resulted into decrease in the mixing height.

Graph 5: Concentration of $PM_{2.5}$ in Pre, During and Post Diwali-2020



	07-Nov	08-Nov	09-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov
North T.T. Nagar	163	156	159	172	147	99	84	167	42	64	60	65	64	52	48
Nehru Nagar	144	156	158	169	171	111	88	345	51	90	94	76	73	95	85

Graph 6: $PM_{2.5}$ concentration on Diwali Day in the year 2019 & 2020



	North T.T. Nagar	Nehru Nagar
27.10.2019	121	89
14.11.2020	167	345

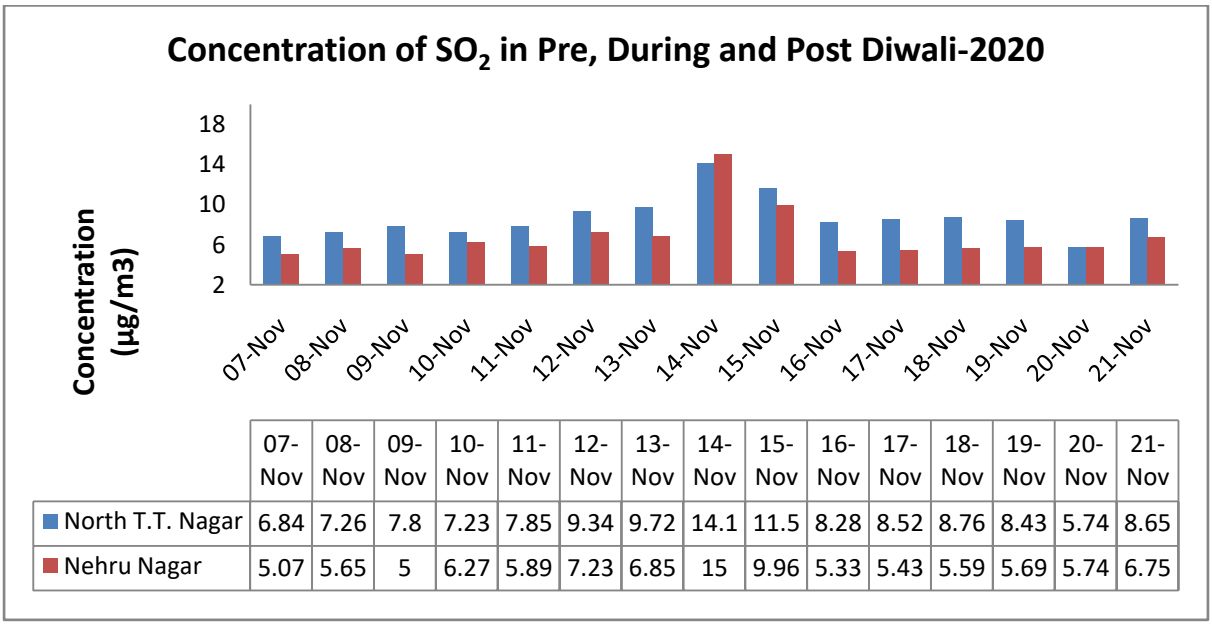
Sulphur di-oxide (SO_2)

During the entire monitoring period from 7 to 21.11.2020, SO_2 values were detected within the prescribed standard limit 80µg/m^3 for 24 hrs.

The maximum concentration of SO_2 was detected on Diwali day (14.11.2020) i.e. 14.15µg/m^3 and 15µg/m^3 at Sahkar Bhawan, North T.T. Nagar and Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar respectively due to bursting of fire crackers.

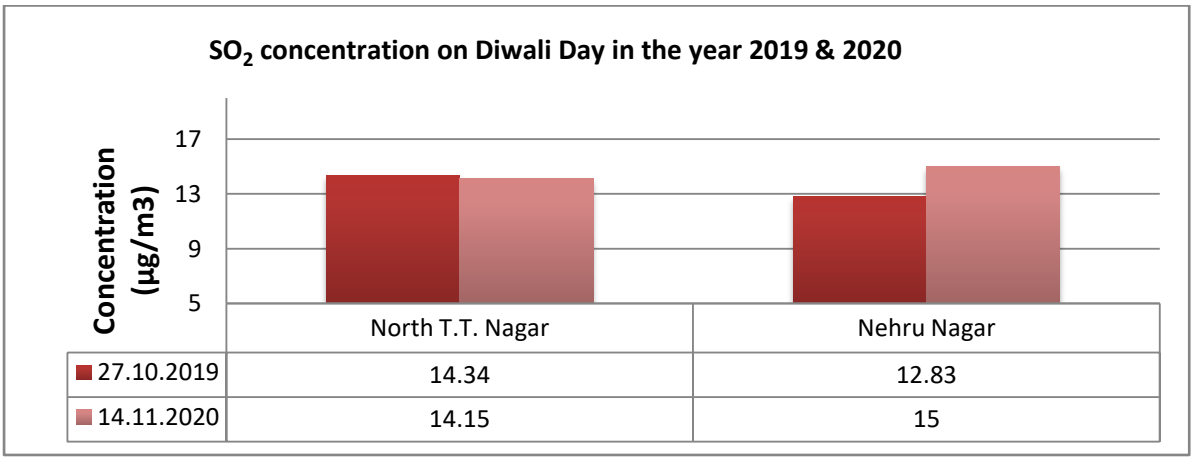
However, the average concentration of SO_2 was detected almost similar on Diwali Day (2020) as that was observed on Diwali Day (2019) at both the locations. The SO_2 concentrations on monitoring days and comparison with the last year (2019) on Diwali day are depicted in **Graph 7** & **8** respectively.

Graph 7: Concentration of SO_2 in Pre, During and Post Diwali-2020



	07-Nov	08-Nov	09-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov
North T.T. Nagar	6.84	7.26	7.8	7.23	7.85	9.34	9.72	14.1	11.5	8.28	8.52	8.76	8.43	5.74	8.65
Nehru Nagar	5.07	5.65	5	6.27	5.89	7.23	6.85	15	9.96	5.33	5.43	5.59	5.69	5.74	6.75

Graph 8: SO_2 concentration on Diwali Day in the year 2019 & 2020



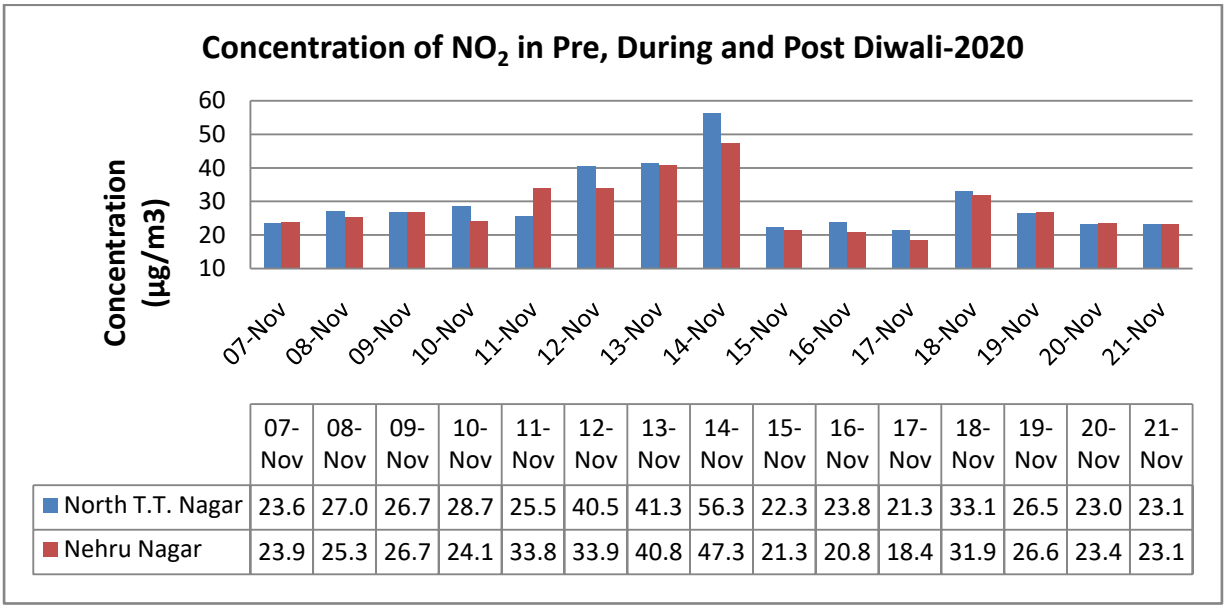
	North T.T. Nagar	Nehru Nagar
27.10.2019	14.34	12.83
14.11.2020	14.15	15

Nitrogen Dioxide (NO_2)

The concentration of NO_2 was detected within the prescribed standard limit 80 µg/m^3 during the entire monitoring period of 15 days at both the locations. The average NO_2 concentrations are shown below in the **Graph 9**.

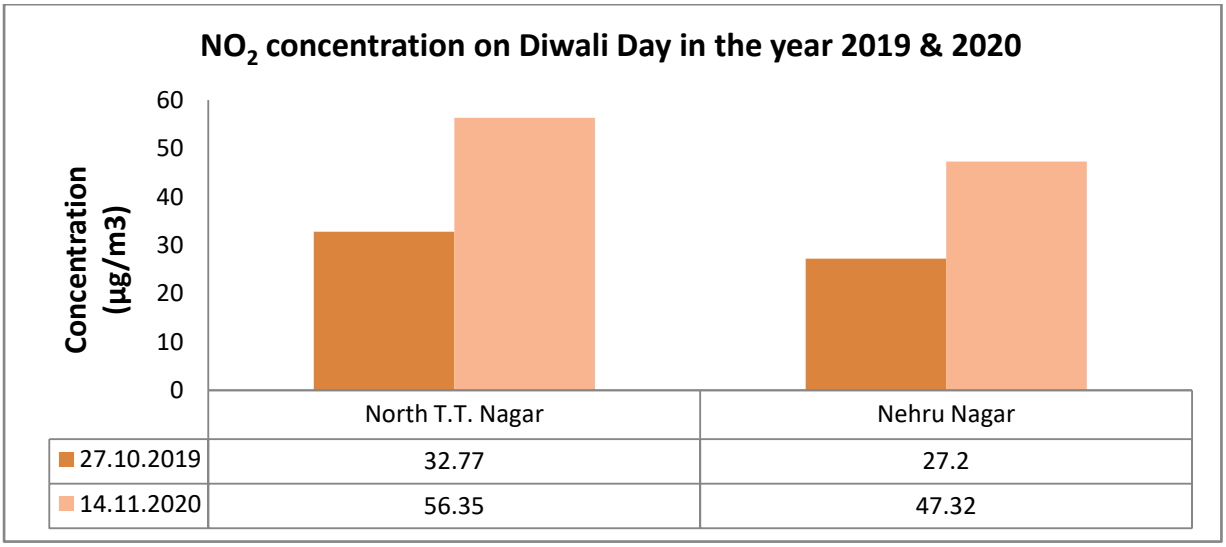
However, on the day of Diwali (2020) the NO_2 concentration was exceeding as that observed on the last year Diwali day (2019) at both the locations. The concentration of NO_2 on Diwali Day (14.11.2020) was 56.35 µg/m^3 at Sahkar Bhawan, North T.T. Nagar and 47.32 µg/m^3 at Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar as compared to last year (27.10.2019) i.e. 32.77 µg/m^3 and 27.20 µg/m^3 respectively. The level of NO_2 found in 2020 & 2019 are shown in **Graph 10**.

Graph 9: Concentration of NO_2 in Pre, During and Post Diwali-2020



	07-Nov	08-Nov	09-Nov	10-Nov	11-Nov	12-Nov	13-Nov	14-Nov	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov	21-Nov
North T.T. Nagar	23.6	27.0	26.7	28.7	25.5	40.5	41.3	56.3	22.3	23.8	21.3	33.1	26.5	23.0	23.1
Nehru Nagar	23.9	25.3	26.7	24.1	33.8	33.9	40.8	47.3	21.3	20.8	18.4	31.9	26.6	23.4	23.1

Graph 10: NO_2 concentration on Diwali Day in the year 2019 & 2020



Air Quality Index

Air Quality Index: Air Quality Index is a tool for effective communication of air quality status to people which is easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour. There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. Each of these categories is based on ambient concentration values of air pollutants and their likely health impacts. The AQI of the normal day, Diwali day and post Diwali day are given below:

Air Quality Index	Pollution Category	Related Health Impact
0-50	Good	Minimal Impact.
51-100	Satisfactory	May cause minor breathing discomfort to sensitive people.
101-200	Moderate	May cause breathing discomfort to people with lung diseases such as Asthma and discomfort to people with heart disease Children and older adults.
201-300	Poor	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart diseases.
301-400	Very Poor	May cause respiratory illness to the people on prolonged exposure. Effect may be more prolonged exposure in people with lung and heart disease.
>401	Severe	May cause respiratory effects even on healthy people and serious health effect on people with lung/heart diseases.

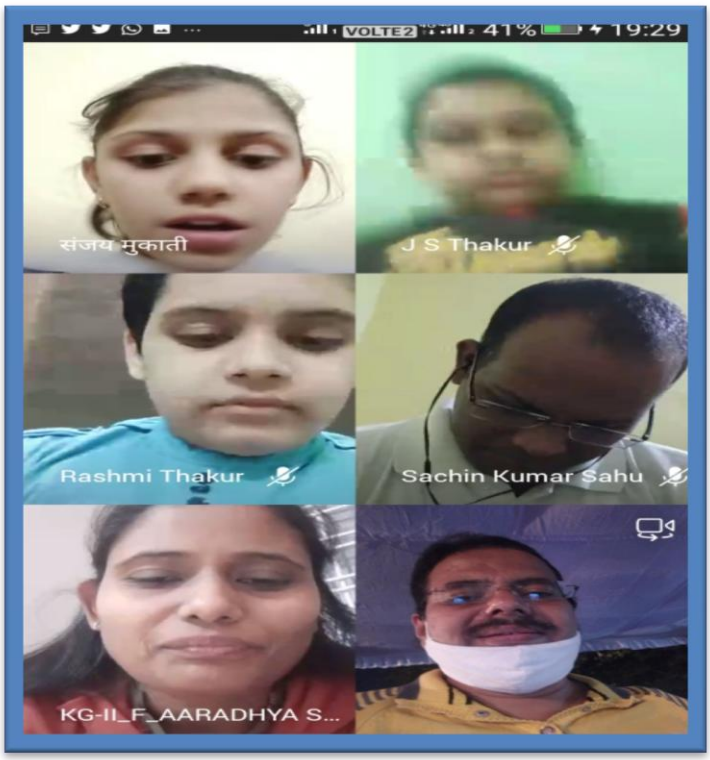
Table 7: Air Quality Index of pre Diwali day, during Diwali day and post Diwali day are as given below:

Date	Location					
	Sahkar Bhawan, North T.T. Nagar (Commercial)			Govt.Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar (Residential)		
	AQI	Category	Prominent Parameter	AQI	Category	Prominent Parameter
07.11.2020	333	**Very Poor**	$PM_{2.5}$	318	**Very Poor**	$PM_{2.5}$
08.11.2020	328	**Very Poor**	$PM_{2.5}$	328	**Very Poor**	$PM_{2.5}$
09.11.2020	330	**Very Poor**	$PM_{2.5}$	329	**Very Poor**	$PM_{2.5}$
10.11.2020	340	**Very Poor**	$PM_{2.5}$	338	**Very Poor**	$PM_{2.5}$
11.11.2020	321	**Very Poor**	$PM_{2.5}$	339	**Very Poor**	$PM_{2.5}$
12.11.2020	230	**Poor**	$PM_{2.5}$	270	**Poor**	$PM_{2.5}$
13.11.2020	180	**Moderate**	$PM_{2.5}$	193	**Moderate**	$PM_{2.5}$
14.11.2020	336	**Very Poor**	$PM_{2.5}$	473	**Severe**	$PM_{2.5}$
15.11.2020	97	**Satisfactory**	PM_{10}	111	**Moderate**	PM_{10}
16.11.2020	120	**Moderate**	PM_{10}	200	**Poor**	$PM_{2.5}$
17.11.2020	112	**Moderate**	PM_{10}	213	**Poor**	$PM_{2.5}$
18.11.2020	117	**Moderate**	$PM_{2.5}$	153	**Moderate**	$PM_{2.5}$
19.11.2020	113	**Moderate**	$PM_{2.5}$	143	**Moderate**	$PM_{2.5}$
20.11.2020	118	**Moderate**	PM_{10}	217	**Poor**	$PM_{2.5}$
21.11.2020	101	**Moderate**	PM_{10}	183	**Moderate**	$PM_{2.5}$

- PM_{10} and $PM_{2.5}$ were found prominent parameter out of 4 monitored parameters i.e. PM_{10}, $PM_{2.5}$, SO_2 & NO_2.
- The AQI values were found during the pre Diwali in the range of **180 to 340** at Sahkar Bhawan, North T.T. Nagar and **193 to 339** at Govt.Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar.
- The air quality index on Diwali Day was found very poor i.e. **336** at Sahkar Bhawan, North T.T. Nagar and at Govt.Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagarwas found severe i.e. **473**.
- The AQI values found during post Diwali in the range of **97 to 120** at Sahkar Bhawan, North T.T. Nagar and **111 to 217** at Govt. Balak Ucchter Madhyamic Vidyalaya, Kotra-Sultanabad, Nehru Nagar.

Mass Awareness Activities during Diwali 2020

Mass awareness plays an important role to spread awareness among masses by using technology, social media, Webinar etc. Generally it is observed that during Diwali festival the ambient noise and air quality levels are found above the prescribed limits due to the fire crackers bursting. As per the direction of the Hon'ble Supreme Court the state and central Governments have to promote the ill effects of fireworks through advertisements, encourage teachers to convince their students and explain the bad effects of fire crackers and advised not to burst fireworks.



In compliance of the above, CPCB Regional Directorate Bhopal has conducted some programs to create awareness among public and to give wide publicity on ill-effects of fire crackers. In view of corona pandemic situation efforts were made by the office to educate and sensitize the children, parents; public through online platform.

Under mass awareness programmes public talks have been organised at various Durga Pandals in the city where demonstration of RDS, noise level meter were also given to public. Environmental Quiz was organised on Microsoft Meet platform for school students to deliver the message of Eco-friendly Diwaliand awareness about availability of green crackers in market.

The Regional Directorate Bhopal continuously making efforts to ensure that people enjoy a safe Diwali through awareness programme and inspiring and motivated the students not to burst firecrackers for safety of environment & health.

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