ASSESSMENT OF AMBIENT AIR QUALITY
OF LUCKNOW CITY

DURING PRE-DIWALI
DIWALI
AND
POST-DIWALI

2018

सीएसआईआर-भारतीय विषविज्ञान अनुसंधान संस्थान, लखनऊ
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Assessment of Ambient Air Quality during Pre-Diwali, Diwali and Post-Diwali Festival, November 2018

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CSIR-Indian Institute of Toxicology Research (CSIR-IITR), Lucknow conducted Air Quality survey at 9 locations (Aliganj, Vikasnagar, Indiranagar, Gomtinagar, Charbagh, Aminabad Chowk, Alambagh and Amausi) of Lucknow city to assess the impact of fireworks on the environment during the Diwali festival, 2018. Monitoring results revealed that the respirable particulates during pre-Diwali, Diwali and post-Diwali are well above the National Ambient Air Quality Standards of 60 and 100 µg/m^3 for $PM_{2.5}$ and PM_{10} respectively (Table 1).

During the major event on Diwali night November 7th, 2018 the mean level of $PM_{2.5}$ increased from 170.0 to 679.1 µg/m^3 over the pre-Diwali night and reduced to 265.6 µg/m^3 during post-Diwali night. Similarly on Diwali night, the level of PM_{10} also increased from 262.0 to 989.5 µg/m^3 over the pre-Diwali night and reduced to 385.6 µg/m^3 during post-Diwali night. The bursting of crackers is responsible for the increasing trend of particulate levels as the other sources such as traffic and industrial activities were at the minimal contribution levels during the period on account of Diwali holidays.

On the Diwali night $PM_{2.5}$ increased by 299.5% whereas the increase in PM_{10} over the pre-Diwali night was 277.6%. Further, the higher levels of particulates continued during post-Diwali night by 56.3% and 48.7% for $PM_{2.5}$ and PM_{10} respectively over pre-Diwali night levels (Fig. 1).

In case of SO_2, the mean level was found to be within prescribed limits. However, mean level of SO_2 on the Diwali night increased from 12.7 to 27.3 µg/m^3 and on post-Diwali mean SO_2 level was 18.0 µg/m^3, which indicates that the levels increased by 114.7% and 41.5% on the Diwali night and post-Diwali night respectively over the pre-Diwali night.

The mean level of NO_2 was found to be within prescribed limits. On Diwali night the mean NO_2 value increased from 44.4 to 77.8 µg/m^3 over the pre-Diwali night. On the post-Diwali night, mean level of NO_2 was increased to 50.9 from 44.4 µg/m^3 on pre Diwali night. In terms of percentage, NO_2 level increased by 75.4% on Diwali night and increased by 14.8 % on post-Diwali night over the pre-Diwali night.

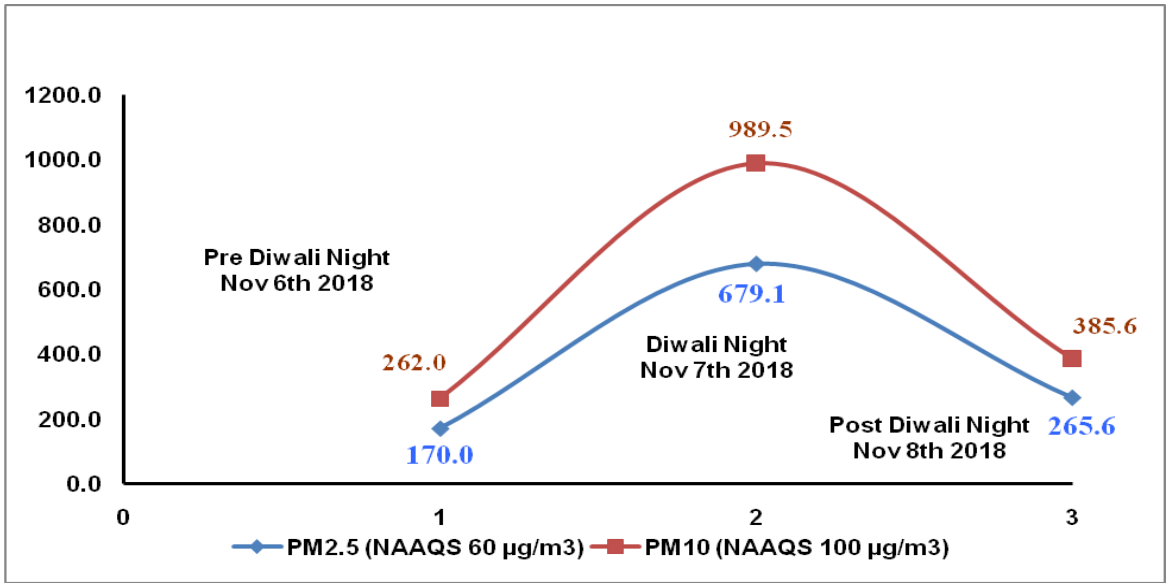

Fig. 1. Profile of respirable particulates during the night time of Diwali Festival.

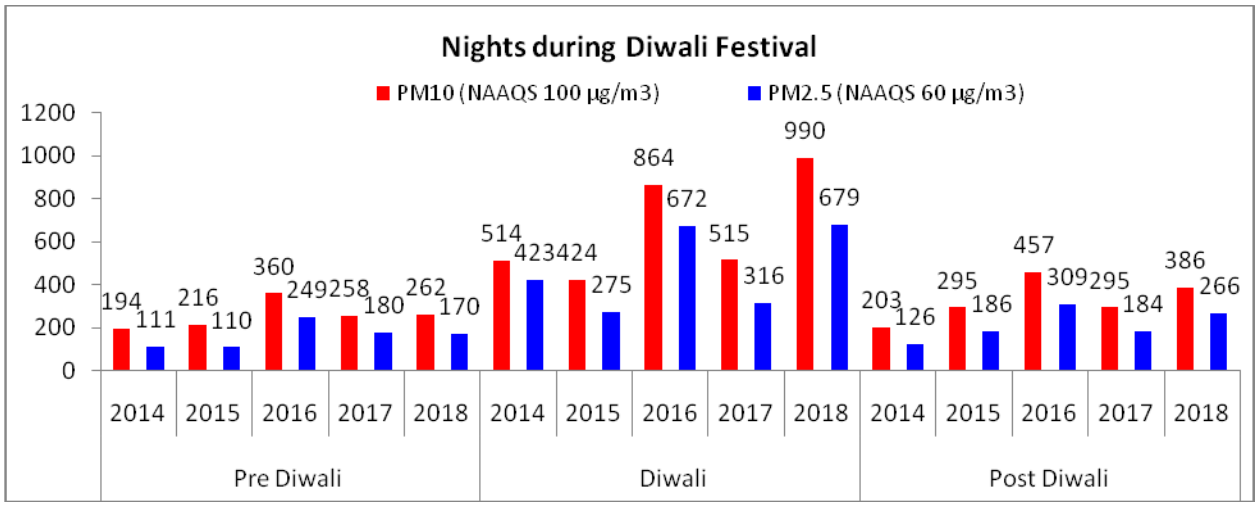

Fig. 2. Levels of respirable particulates (PM_{10} and $PM_{2.5}$) concentration during 2014, 2015, 2016, 2017 and 2018 (Diwali Festival).

Table 1. CSIR-IITR Diwali 2018 Pollution Survey

Pollutants/ Locations	**Pre-Diwali 2018** (November 06th 2018)		**On-Diwali 2018** (November 7th 2018)		**Post-Diwali 2018** (November 8th 2018)	
PM_{10} ($\mu g/m^3$)	Day (6:00 am to 6:00 pm)	Night (6:00 pm to 6:00 am)	Day (6:00 am to 6:00 pm)	Night (6:00 pm to 6:00 am)	Day (6:00 am to 6:00 pm)	Night (6:00 pm to 6:00 am)
Aliganj	202.3	282.9	218.1	1057.1	205.5	301.9
Vikas Nagar	197.8	348.7	258.3	1123.1	250.5	344.6
Indira Nagar	225.6	258.3	290.3	1285.5	298.2	462.2
Gomti Nagar	211.6	263.7	259.4	991.8	164.6	308.2
Charbagh	214.1	284.0	322.5	996.4	279.3	625.5
Alambagh	214.8	225.1	193.9	953.2	148.9	302.7
Aminabad	191.9	244.8	308.6	1050.1	158.8	408.2
Chowk	318.1	259.8	228.3	807.6	256.9	359.9
Amausi	230.6	190.9	212.6	640.7	142.7	357.4
$PM_{2.5}$ ($\mu g/m^3$)						
Aliganj	151.2	191.7	207.1	797.5	146.1	208.7
Vikas Nagar	149.2	239.5	176.3	879.8	155.3	257.9
Indira Nagar	100.2	152.4	137.4	801.9	129.5	248.7
Gomti Nagar	113.2	173.4	227.9	521.2	122.7	221.2
Charbagh	137.1	192.6	195.8	792.9	146.2	489.2
Alambagh	154.1	162.0	110.8	565.8	129.4	186.4
Aminabad	131.8	166.2	162.4	857.1	116.2	291.2
Chowk	141.2	132.9	167.2	519.9	177.6	224.6
Amausi	163.5	119.2	201.7	375.8	114.7	262.8
SO_2 ($\mu g/m^3$)						
Aliganj	14.8	11.6	14.6	33.6	13.2	15.3
Vikas Nagar	16.6	11.7	12.7	30.8	18.7	22.1
Indira Nagar	12.7	18.4	14.3	27.8	23.1	18.8
Gomti Nagar	12.2	14.7	10.7	27.4	12.7	13.8
Charbagh	12.5	13.7	17.5	28.1	17.1	22.7
Alambagh	12.4	10.6	15.9	21.9	9.6	15.9
Aminabad	11.8	10.8	11.7	25.8	18.3	14.7
Chowk	20.1	11.7	13.5	25.5	16.0	17.8
Amausi	17.4	11.3	12.2	24.9	19.5	20.9
NO_2 ($\mu g/m^3$)						
Aliganj	27.4	33.0	69.8	108.3	52.7	61.8
Vikas Nagar	41.8	49.2	50.2	70.6	45.0	47.9
Indira Nagar	34.7	43.9	46.5	61.3	36.2	43.9
Gomti Nagar	47.5	51.7	68.5	83.2	30.3	37.1
Charbagh	36.5	44.1	73.4	122.7	57.6	69.9
Alambagh	40.8	46.8	38.8	56.6	41.5	58.4
Aminabad	44.2	48.2	51.5	62.0	49.2	45.4
Chowk	36.6	48.3	38.6	75.0	49.5	54.3
Amausi	48.7	34.1	49.8	60.6	29.7	39.8

ND= Not Done

Noise Level

Noise level was recorded during Pre-Diwali, Post-Diwali and On-Diwali night to observe the impact of bursting of fire cracker at following locations. The monitoring was carried out during 7 pm to midnight for near about 30 minutes at each location. The maximum noise level was recorded as 86.9 dB(A) at Chowk area whereas minimum was recorded as 77.6 dB(A) at Aminabad on Diwali night. The sound waves generated from the bursting of crackers at a level higher than 80 dB(A), may damage eardrum and may induce temporary or permanent deafness. Exposure to high levels of noise may trigger problems like annoyance, irritation, hypertension, stress, hearing loss, headache and sleep disturbance. The recorded noise levels are given in Table 2.

Table 2. Noise Level on Pre-Diwali, Diwali and Post-Diwali night

Locations	**Pre-Diwali** (November 06th, 2018)	**On-Diwali** (November 07th, 2018)
	Noise dB(A)	
Charbagh (10:00-10:30 PM)	71.8	81.8
Chowk (11:00- 12:00 PM)	71.2	86.9
Aliganj (09:00- 10:00 PM	66.4	83.9
Vikas Nagar (08:00- 09:00 PM)	65.8	86.5
Indira Nagar (9:00-9:30 PM)	66.4	85.9
Aminabad (10:00-11:00)	68.6	77.6

The CSIR-IITR mission towards pollution free environment and minimizing/ regulating the use of crackers is an integral part of all activities/ exhibitions and programmes amongst the students, family members of staffs, general public and media persons. The meteorological conditions, particularly wind speed and direction play a major role in the transport and dispersion of the pollutants from their source. Particularly north Indian cities have recorded extremely high air pollution during Diwali festival in the last couple of years as the cool and calm meteorological conditions prevent the dilution, movement and dispersion of pollutants till late morning. Air quality results observed during the year clearly indicate that the air quality of the city significantly deteriorated due to fireworks for the short period which could severely affect human health particularly in case of children, senior citizens and people with respiratory issues. In general, fire cracker contains various elements like aluminum, antimony, sulphide, perchlorate, barium nitrate, lithium, copper, strontium, cadmium etc., which are responsible for causing Alzheimers' disease, thyroid, gastrointestinal problems, muscular weakness, respiratory problems, hormonal disbalance etc. It may even cause cancer. Therefore the firing of crackers should be discouraged during Diwali.