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Seasonal Variations in SO_2, NO_2 and PM_{10} Concentrations in Ambient Air of Saharanpur, Uttar Pradesh

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ABSTRACT

Air contamination has been recognized as a difficult issue all through the world which makes real misfortune living creatures, crops, plant development and yield. Earlier, the rectrictions of air pollution to metropolitan and industrial area. Yet, it has progressed toward becoming a wide problem due to development of industries, transportation, population increase and deforestation in commissionary and district level city. Air contamination is a very broad area for researchers, so it is not possible to study all parameters in a research work. The present investigation manages the evaluation of surrounding air quality as for SO_2, NO_2 and PM_{10} have been selected for proposed research. Saharanpur a commissionary/district level city selected and it may be an emerging area for research work on air pollution. There is no study on SO_2, NO_2 and PM_{10} levels till now. The studies in growing city like Saharanpur will give us a proper idea regarding the pattern of the increase in the air contamination in other similar cities. The experimental results obtained from the different air quality categories according to national air quality gauges (NAAQS) at different site. The national method of sampling and analysis i.e.; BIS, CPCB Delhi was used for the proposed study. The SO_2, NO_2 and PM_{10} levels were observed during July 2015 to June 2016 on fortnightly basis at three sites using active sampling.

1. Introduction

Clean air is one of the basic requirements for good environment, human and living beings life. Air pollution generate to be well known ecological issue world wide It can represent a genuine risk to living beings well being in the event that it surpasses as far as possible (1-2).The origin of air contamination is for the most part in anthropogenic outflow sources. This includes automobiles, industries what's more, household fuel ignition. The air pollutants so generated are detrimental to human health. In addition, they cause negative impacts in visible and invisible way. Air contamination happens when the air contains substances in amounts that could hurt the solace or strength of people and creatures or could harm plants and material. These substances are called air contaminations and can be either particles, fluids or vaporous in nature (3). Keeping the air quality adequate has turned into a vital undertaking for chiefs and for non-legislative association. Particulate issue and vaporous outflows from businesses and auto debilitates are in charge of rising inconveniences expanding respiratory infections and decay of creative and social patrimony in urban focuses (4).The single most vital factor in charge of the disintegration of air quality in the urban communities is the exponential increment in the quantity of vehicles. Vehicular contamination adds to 70 % of aggregate contamination in Delhi, 52 % in Mumbai and 30 % in Calcutta (5-7).

WHO/UNEP report (8) uncovers air contamination issue in metropolitan urban communities of India has 23 noteworthy urban areas of more than one million individuals and surrounding air contamination levels surpass the WHO guidelines in a significant number of them (9). In a later gauge of WHO, A aggregate of thirteen Indian urban areas are among twenty most dirtied urban areas of the world as far as the particulate issue air pollution (10). In most urban zones, discharges from activity are a noteworthy benefactor of destructive poisons, for example, NOx and particulate issue (11). Among the unsafe synthetic exacerbates the ignition of SO_2, NO_2 and some strong particulates (12).

The AQI (Air Quality Index) for the pollutants is an index to indicate to monitor trends of the medium and long term back ground pollution levels higher in urban areas; this is generally because of the centralization of human activities that occur in cities (13).Environmental Protection Agency (EPA) is using the AQI for wide spread pollutants regulated by clean air viz.SO_2, NO_2 and Particulate matter.

CPCB & Government of India has set National Ambient Air Quality Standards (NAAQS) in 2009 to protect against harmful health effects.

The present study focuses on measurement of the levels of SO_2, NO_2 and PM_{10} in atmospheric environment of Saharanpur city will be monitored fortnightly basis of selected locations during July 2015 to June 2016. The national standard method of sampling and analysis i.e (14) Bureau of Indian Standards (BIS) and Central Pollution Control Board (2011), Delhi will be used for ambient air analysis (15-18).

2. Material and Method

2.1) Study Area

Saharanpur is the northernmost of the region of Uttar Pradesh, India. It is located at 29.97^0N, 77.55^0E, about 140km

south-southeast from Chandigarh and 170km north- northeast from Delhi. It has elevation of 284 meters. The population of the city was 705,478 lakh as per 2011 census with population density 940/km^2 and covered area of 3,689 km^2. Saharanpur has tropical atmosphere as a result of the Himalayan locale over this northern district. Temperature range from an average 23.9^{0}C during the year. The vehicular population in the city is expanding day by day. About 19387 vehicles were recorded in Saharanpur up to 2002 (RTO, Saharanpur) which increasing at 20% per year**.**

There are three sites taken for setting up the examining locales for monitoring of SO_2, NO_2 and PM_{10} on land use pattern i.e.

I. **Residential area -** Punjabi Bagh, Raj Vihar Colony near Gori Shankar Mandir Saharanpur.
II. **Industrial area -** Railway Depot Area. Himmat Nagar, Mahipalpur near RTO Office, Saharanpur.
III. **Traffic Intersection Area -** Clock Tower Ambala Road, Railway Road Saharanpur.

2.2*) *Study Site

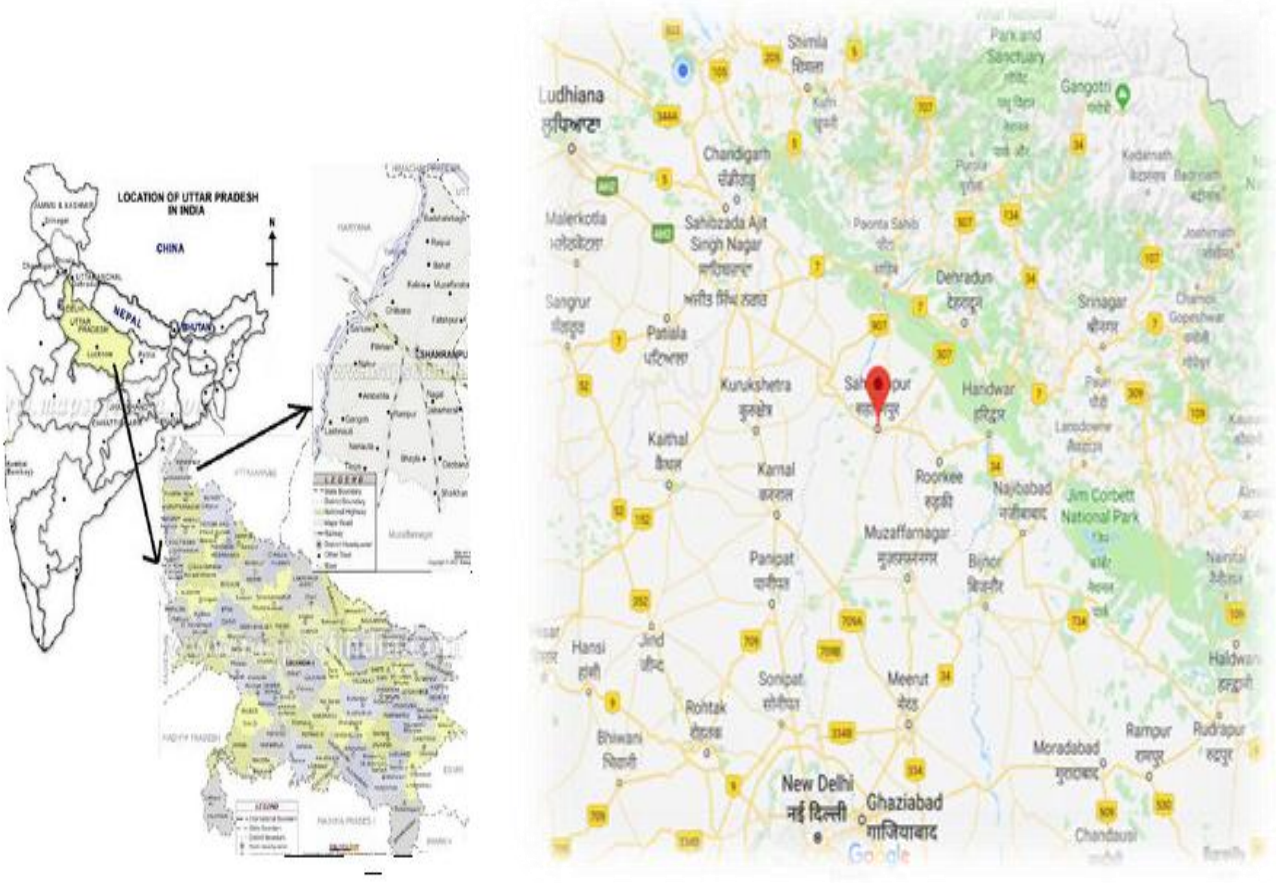

Fig-1 Maps of the sampling site

2.3*) *Sampling, Analysis/ Result & Disccussions

Monitoring of SO_2, NO_2 and PM_{10} by using Respirable dust sampler (Model-APM 460NL, Envirotech, CSIR/NEERI KNOWHOW) at a stream rate of 1.0-1.2m^3/min with a frequency of 4 times each fortnight from each site at interval of every 6 hrs. over 24 hrs. for SO_2, NO_2. The analysis of SO_2 and NO_2 was done using Bureau of Indian Standards (BIS) methods. A known quantity was gone through the impinge containing known volume of engrossing arrangement, sodium tetrachloromercurate (TCM). The dichlosulphitomercurate complex is formed which is measured at 560nm on spectrophotometer. Whereas, NO_2 was absorbed in absorbing solution of sodium hydroxide, which formed a stable solution of sodium nitrite. The nitrite particle created was resolved colorimetrically by responding the uncovered retaining reagent with phosphoric corrosive, sulphanilamide and N (1- nephthyl) ethylenediamide di hydrochloride at a wavelength 540nm.

For PM_{10} from one site take 3 samples fortnightly every 8hrs. Interval over 24hrs. each time, (three shifts). Whatman glass fiber channel paper–GF/A was used. The distinction in introductory and last weight of the channel paper gave the aggregate amount of RSPM/PM_{10} gathered over the 24 hours time frame. The estimations of PM_{10} calculated in µg/m^3.

Season Description:
Monsoon : July, August, September
Post monsoon: October
Winter: November, December, January, February
Summer: March, April, May, June

Table 1: Air Quality Results of SO_2, NO_2 and PM_{10} at three monitoring stations and 24 hours monthly average of Temperature, Humidity and Wind Speed during July 2015 to June 2016

S.No.	Date	Residential Area			Industrial Area			Traffic intersection			24 Hour monthly Average		
	Fortnight	24 Hour SO2 Average	24 Hour NO2 Average	24 Hour PM10 Average	24 Hour SO2 Average	24 Hour NO2 Average	24 Hour PM10 Average	24 Hour SO2 Average	24 Hour NO2 Average	24 Hour PM10 Average	Temperature	Humidity	Wind Speed
	YEAR 2015-16										* c	%	k m / h
1	01.07.2015	8.81	19.38	104.14	10.53	24.02	157.65	12.79	25.25	158.7	27	85	6
2	16.07.2015	8.45	20.77	111.02	9.49	24.51	156.95	12.7	25.72	173.52			
3	03.08.2015	8.21	21.08	107.2	9.86	24.01	167.44	12.47	25.55	167.78	26	86	6
4	18.08.2015	9.54	21.29	105	10.5	25.63	159.94	12.63	27.42	177.64			
5	01.09.2015	10.28	20.88	125.66	12.46	23.14	168.64	12.48	27.52	161.49	29	76	8
6	16.09.2015	10.22	20.23	117.88	11.95	23.31	174.84	12.54	25.39	168.64			
7	01.10.2015	10.1	22.26	127.29	12.69	26.09	161.98	13.42	26.7	195.25	23	68	7
8	16.10.2015	10.24	21.14	123.15	12.92	24.24	170.6	13.06	27.95	168.02			
9	02.11.2015	11.45	23.69	140.81	13.08	25.24	175.58	13.99	28.78	240.02	19	69	6
10	17.11.2015	12.1	23.64	130.16	13.13	27.31	179.73	13.89	27.64	238.34			
11	02.12.2015	12.03	22.29	138.76	14.18	27.48	169.06	14.26	28.38	267.66	14	75	8
12	17.12.2015	11.71	22.17	137.95	13.19	26.94	172.84	13.5	27.5	245.36			
13	01.01.2016	10.53	21.44	122.56	13.97	27.5	184.03	14.26	28.6	211.82	13	71	6
14	15.01.2016	11.64	21.6	121.15	12.24	27.41	197.44	14.33	27.33	191.44			
15	01.02.2016	12.27	21.31	128.38	12.9	27.53	170.45	14.36	27.83	174.81	17	62	4
16	16.02.2016	11.79	20.85	127.17	13.33	27.31	162.74	13.85	29.06	174.17			
17	01.03.2016	10.08	21.26	128.26	11.62	25.24	171.27	12.82	28.56	203.43	22	57	8
18	16.03.2016	10.92	19.31	130.68	12.66	24.96	172.55	13.85	27.05	200.42			
19	01.04.2016	11.27	21.77	126.39	13.13	26.11	176.68	13.79	27.49	220.06	27	51	6
20	15.04.2016	11.27	22.32	125.31	13.33	26.36	180.4	13.61	27.89	213.73			
21	02.05.2016	10.82	23.29	126.02	13.55	27.27	177.76	14.35	28.86	157.33	29	54	9
22	17.05.2016	10.6	23.6	125.48	13.57	28.81	183	13.88	27.52	161.48			
23	01.06.2016	10.25	20.71	123.88	13.19	27.23	159.65	13.42	27.58	156.6	29	75	6
24	16.06.2016	11.02	22.04	127.57	12.64	27.42	167.63	13.52	26.29	190.75			
1	MONSOON	9.25	20.6	111.81	10.79	24.1	164.24	12.6	26.14	167.96	27	82	7
2	POST MONSOON	10.17	21.7	125.22	12.8	25.16	166.29	13.24	27.32	181.63	23	68	7
3	WINTER	11.69	22.12	130.86	13.25	27.09	176.61	14.05	28.14	217.95	16	69	6
4	SUMMER	10.77	21.78	126.69	12.96	26.67	173.61	13.65	27.65	187.97	27	59	7
	AVERAGE	10.47	21.55	123.64	12.45	25.75	170.18	13.38	27.31	188.87	23.25	69.5	6.75

The air quality data of selected parameters from three different observing stations have been analyzed to determine the status and trend in the encompassing air during the period of July 2015 to June 2016. It has been found that annual average concentrations of PM_{10} are found to exceed the National standards (NAAQS) while the annual average of SO_2 and NO_2 were found to be within the national standards. The CPCB, New Delhi has notified a maximum permissible limit for each air pollutant for specific areas.

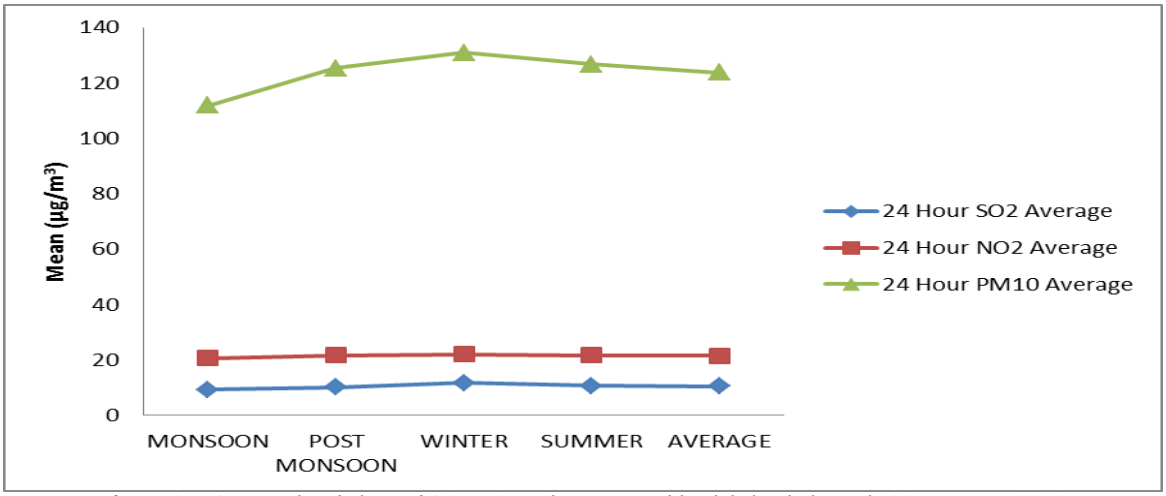

Figure 3.1: Seasonal variations of SO_2, NO_2 and PM_{10} at residential site during July 2015 to June 2016

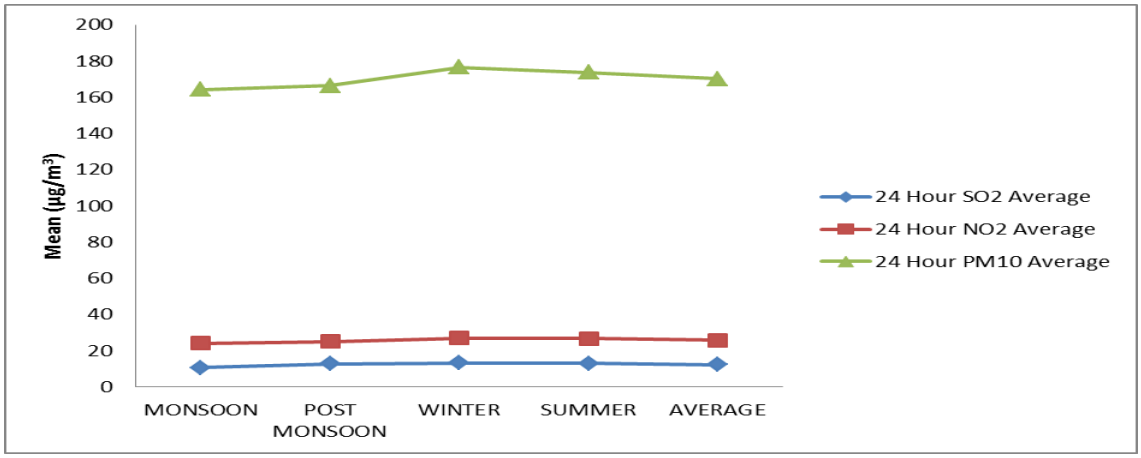

Figure 3.2: Seasonal variations of SO_2, NO_2 and PM_{10} at industrial site during July 2015 to June 2016

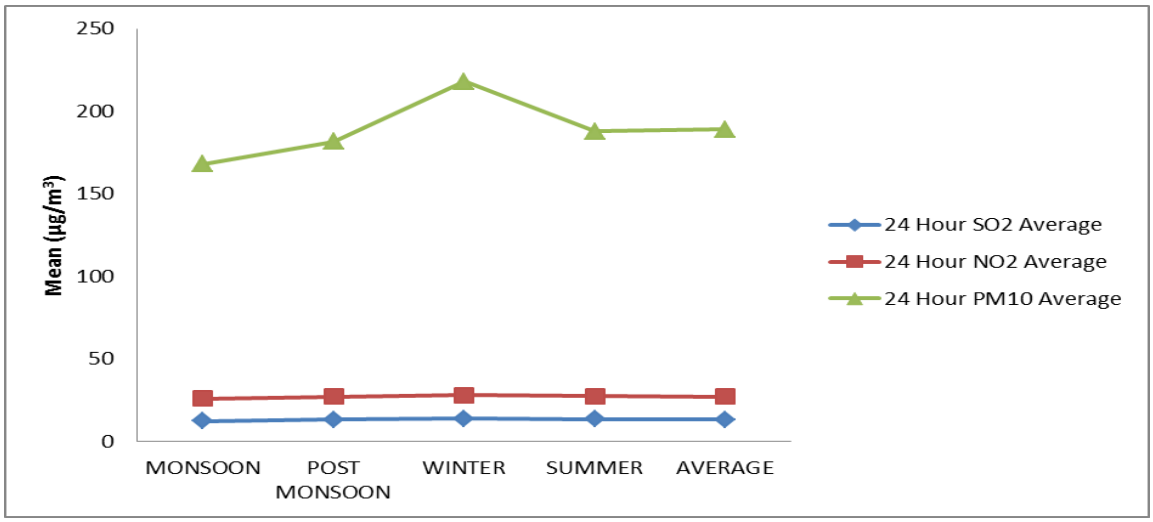

Figure 3.3: Seasonal variations of SO_2, NO_2 and PM_{10} at traffic site during July 2015 to June 2016

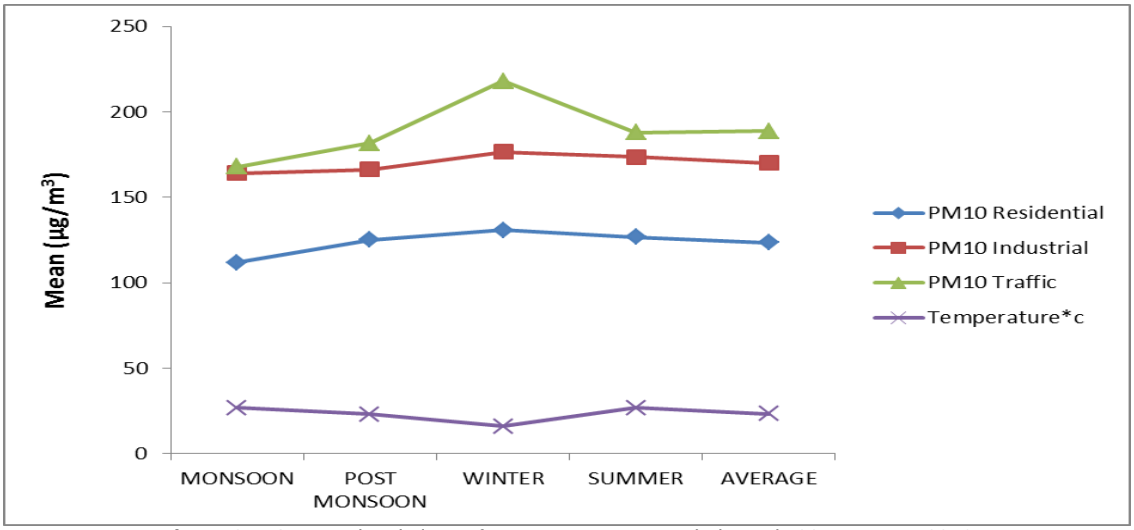

Figure 3.4: Seasonal variations of PM_{10} at temperature during July 2015 to June 2016

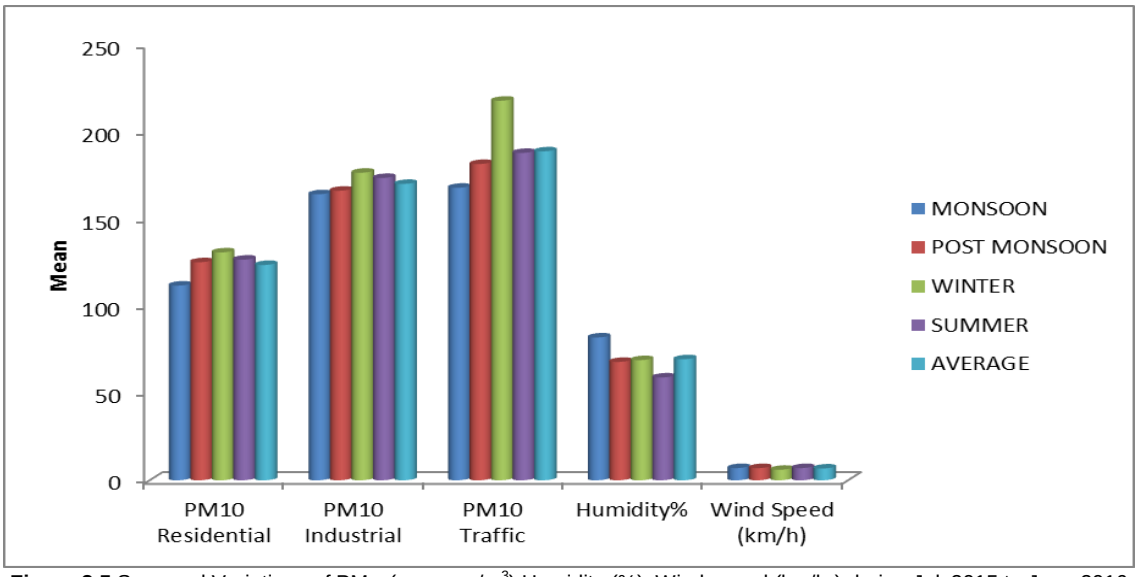

Figure 3.5 Seasonal Variations of PM_{10} (conc. µg/m^3),Humidity (%), Wind speed (km/hr) during July2015 to June 2016

3. Conclusion: This study concludes that the concentration of three parameters recorded at three unique destinations is more than the normal limit. The industrial activities, traffic and illegal e-waste burning effected the environment. These toxic emissions are associated with unfavorable wellbeing impact to the inhabitants. To develop strategy for air quality management of Saharanpur city the first and foremost task is source identification, intensive monitoring data collection and diligent analyses, but may in future we need to formulate some to counteract the increase in air pollution at specific stations as we may never know when the growing urbanization and the activity will expand the air contamination level in local level city substantially more than as far as possible.

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