Assessment of Ambient Air Quality and Noise Level Study of an Urban City

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Abstract: Increasing civilisation and industrialization has given rise to air and noise pollution. Major cities in India or any other countries are facing air pollution problems. Air and noise pollution are also becoming alarming in urban, semi urban and even in villages also. Efforts must be taken to reduce the pollution to protect human health and the environment. Deteriorating air quality and high noise levels has harmful effects on human health, particularly the respiratory, hearing capacity and cardiovascular systems. Air pollution also damage buildings, flora and fauna. This paper investigates Ambient Air Quality and Noise Level study of an Urban City.

Index Terms **- Ambient Air Quality, Noise Level, Industrial Area, Residential Area.**

I. INTRODUCTION

Pure air is a mixture of various gases such as nitrogen, oxygen, argon, carbon dioxide, and small amounts of other gases in a fixed proportion. If the composition of air alters by any means; it is known as air pollution which can lead to effect on human health, environment, and other living creatures. The primary aim of the ambient air quality standards is to provide a basis for protecting public health from adverse effects of air pollution and for eliminating, or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human health and well-being. Air pollution continues to receive a great deal of interest worldwide due to its negative impacts on human health and welfare. Several studies reported significant correlations between air pollution and certain diseases including shortness of breath, sore throat, chest pain, nausea, asthma, bronchitis and lung cancer (Dockery and Pope, 1994, Clean Air 2007). Air pollution has long been recognized as a potentially lethal form of pollution. Entry of pollutants into the atmosphere occurs in the form of gases or particles. Continuous mixing, transformation and trans-boundary transportation of air pollutants make air quality of a locality unpredictable.

The increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological well-being of the people; it is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient standards in respect of noise. Various studies reveal that the road traffic noise is the major contributor of noise pollution in the urban areas. It is a predominant source of annoyance, in developed as well as in developing countries. People who are prone to noise unknowingly develop mental disorders, annoyance, stress, hypertension, loss of concentration, sleeplessness etc.

II. STUDY AREA

Ichalkaranji small erstwhile an urban city which is a princely state has developed into one of the fastest growing Textile sectors of India. Ichalkaranji is situated on latitude of 160-40" North and longitude of 740-32" East. The town is situated at an altitude of 556 meters above the mean sea level. It is situated in the filled-up valley of River Panchaganga. Ichalkaranji is about 29 Kms. away to the South-East of Kolhapur and 26 Kms. away to the South – West of Sangli. Three roads branching from Kolhapur-Sangli road enter the town, one from the West and the other two from the North (Hatkanangale and Sangli sides).

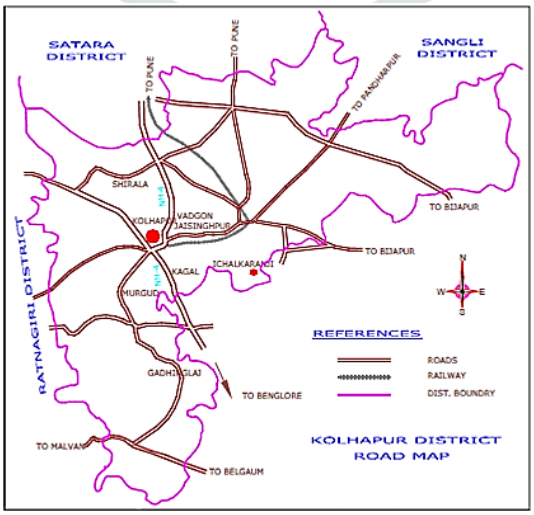

Fig. 1: study area

III. AMBIENT AIR QUALITY STUDY

For analyzing quality of air following sites or Sampling stations were established:

1. Partially crowded area, 2. Highly crowded area 3. Medium crowded area 4. Industrial area 5. Big Industrial area and 6. Outskirt of city

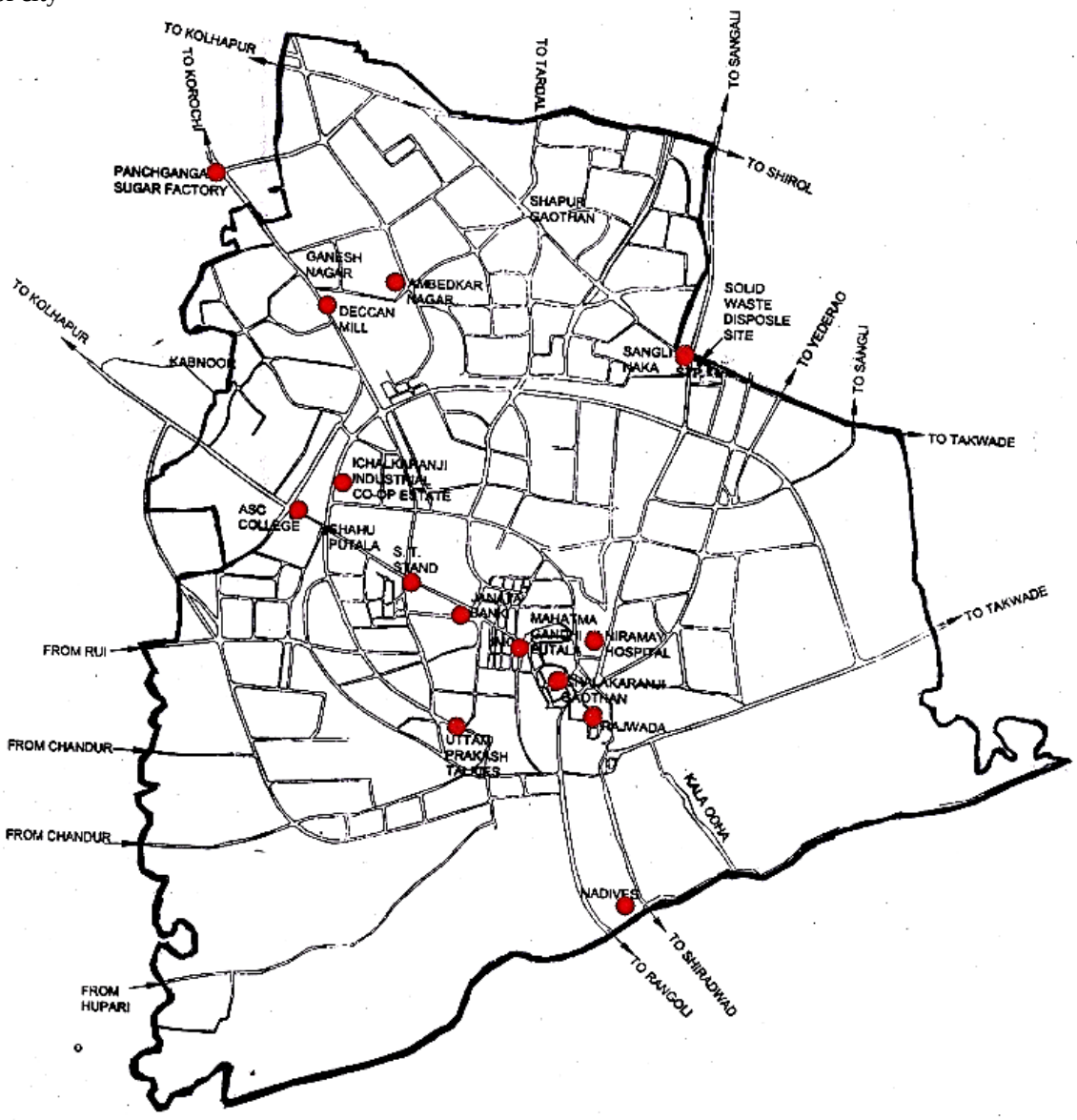

Fig. 2: Air quality and Sound level sampling stations combined map

Suspended particular matter (Avg. SPM) of all sampling stations found higher than ambient air quality standards. It ranges between 247.5 µg/m^3 to 494.5 µg/m^3. NO_x average values are ranging between 53 µg/m^3 to 96 µg/m^3. NO_x values of site 4 and site 5 were found on higher side at 85 µg/m^3 and 96 µg/m^3 respectively. SO_2 average values were found between 45 µg/m^3 to 78 µg/m^3, SO_2 value at site 5 was found to be highest. CO average values were found between 5 to 9 mg/m^3 & found to be on higher side at site 1, site 4 and site 5. Table 1 shows Ambient air quality analysis with Average values of S.P.M., Nox, SO2 & CO in µg/m^3 in City, recorded in May 2020.

Table 1
Ambient air quality analysis with
Average values of S.P.M., No_x, SO_2 & CO in µg/m^3 in City, recorded in May 2020

Site No.	Sampling Station	Area Use	Mean Values of			
			S.P.M. µg/m^3	No_x µg/m^3	SO_x µg/m^3	CO mg/m^3
1	Partially crowded area	Sensitive Areas	288.5	71	48	5
2	Highly crowded area	Commercial Areas	360.5	75	61	9
3	Medium crowded area	Sensitive Areas	320	63.5	51.5	5.5
4	Industrial area	Industrial Areas	494.5	85	72.5	9
5	Big Industrial area	Industrial Areas	469	96	78	9
6	Outskirt of city	Residential Areas	247.5	53	45	7.5

Fig. 3: Equipment used in analysis PEM-HVF-1/110 & NPM-HVS

Table 2
National ambient air quality standards November, 2009

Pollutant	Time Weighted average	Type of area	
		Industrial Area	Residential Area
SO_x	Annual Average*	50 µg/m^3	20 µg/m^3
	24 Hours Avg.**	80 µg/m^3	80 µg/m^3
NO_x	Annual Average*	40 µg/m^3	30µg/m^3
	24 Hours Avg.**	80 µg/m^3	80 µg/m^3
SPM PM10	Annual Average*	60 µg/m^3	60 µg/m^3
	24 Hours Avg.**	100 µg/m^3	100 µg/m^3
RPM PM2.5	Annual Average*	40 µg/m^3	40 µg/m^3
	24 Hours Avg.**	60 µg/m^3	60 µg/m^3
CO mg/m^3	8 hours **	2 mg/m^3	2 mg/m^3
	1 hours Avg.**	4 mg/m^3	4 mg/m^3

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.
Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

Table 2 shows National ambient air quality standards November, 2009. Tables 3 to6 and figures 4 to 7 shows average of suspended particulate matter (SPM) µg/m^3, Nitrogen oxide (NO_X) µg/m^3, Sulphur dioxide (SO_2) µg/m^3 and carbon monoxide (CO) mg/m^3 in city, recorded in May 2020 respectively. Sampling station selected in city are 1. Partially crowded area 2. Highly crowded area 3. Medium crowded area 4. Industrial area 5. Industrial Estate 6. Outskirt of city.

Table 3
Average of suspended particulate matter (SPM) µg/m^3 in city, recorded in May 2020

Values	SITE I	SITE II	SITE III	SITE IV	SITE V	SITE VI
Minimum	270	335	279	441	425	225
Maximum	307	386	361	548	513	270
Mean	288.5	360.5	320	494.5	469	247.5

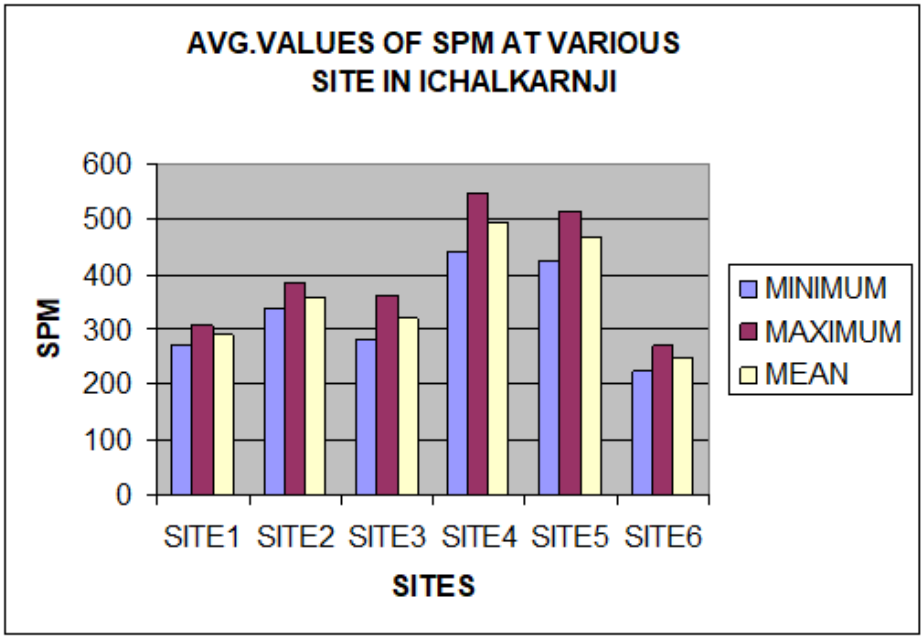

Fig. 4: Average of suspended particulate matter (spm) µg/m^3 in city

Table 4
Average of Nitrogen oxide (NO_X) µg/m^3 in city, recorded in May 2020

Values	SITE I	SITE	SITE III	SITE IV	SITE V	SITE VI
Minimum	59	55	54	69	73	31
Maximum	83	95	73	101	119	75
Mean	71	75	63.5	85	96	53

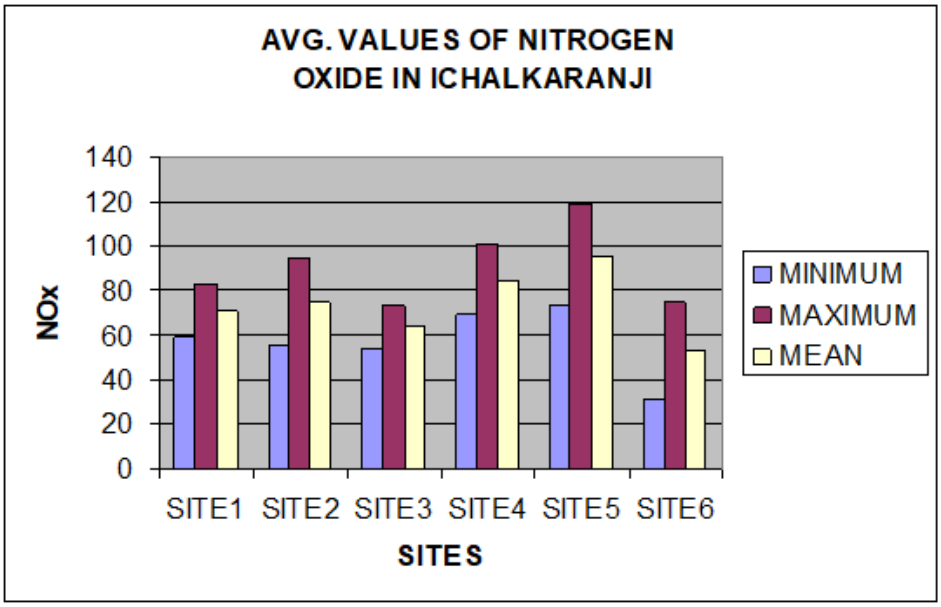

Fig. 5: Average of Nitrogen oxide (NO_X)

Table 5
Average of Sulphur dioxide (SO_2) µg/m^3 in city, recorded in May 2020

Values	SITE I	SITE II	SITE III	SITE IV	SITE V	SITE VI
Minimum	35	43	41	54	59	29
Maximum	61	79	62	91	97	61
Mean	48	61	51.5	72.5	78	45

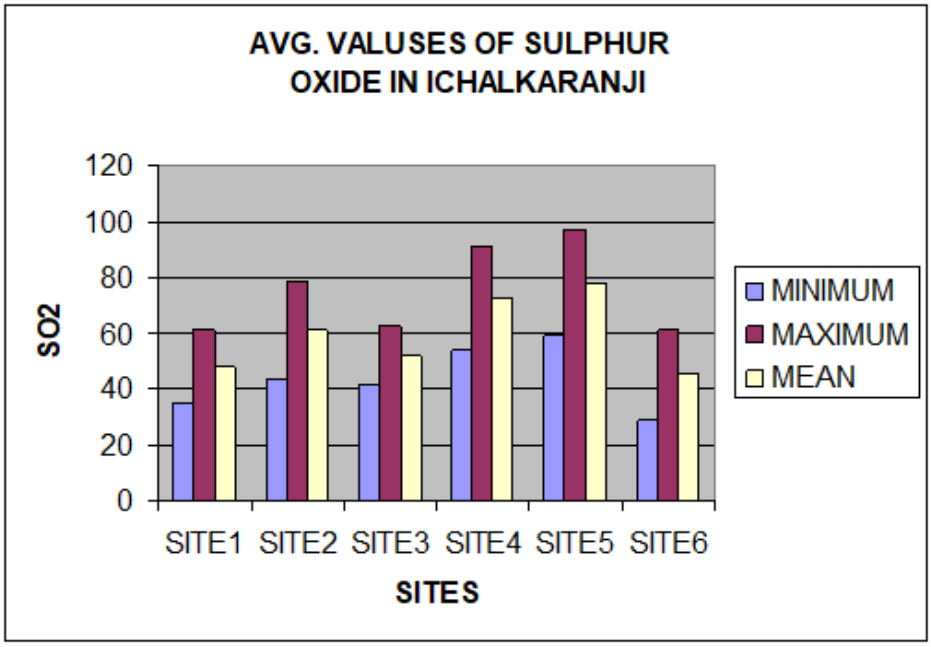

Fig. 6: Average of Sulphur dioxide (SO_2) µg/m^3 in city

Table 6
Average of carbon monoxide (CO) mg/m^3 in city, recorded in May 2020

Values	SITE I	SITE II	SITE III	SITE IV	SITE V	SITE VI
Minimum	3	8	3	7	6	6
Maximum	7	10	8	11	12	9
Mean	5	9	5.5	9	9	7.5

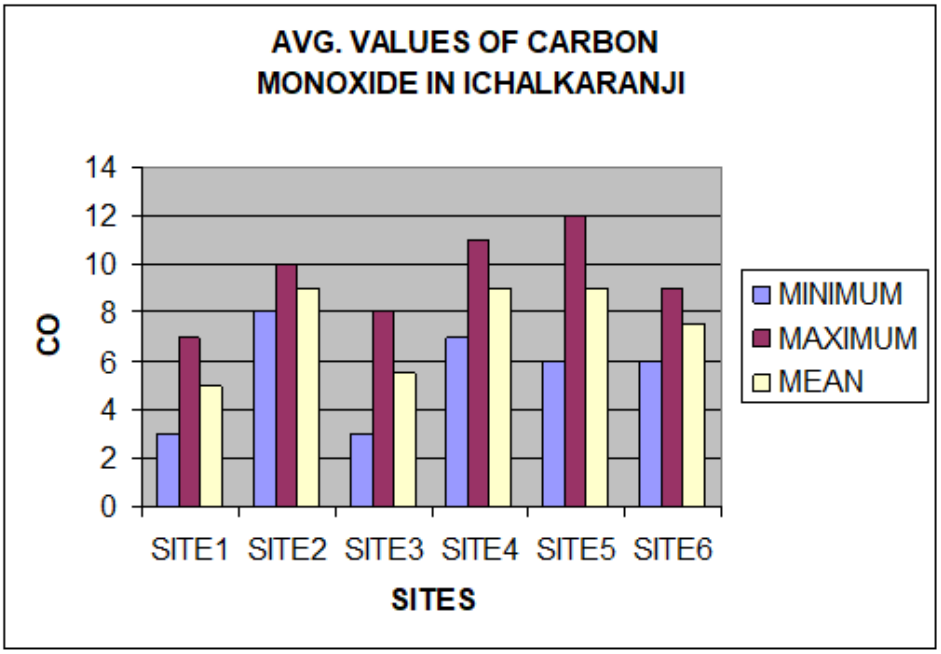

Fig. 7: Average of carbon monoxide (CO) mg/m^3 in city

IV. NOISE LEVEL STUDY

For noise level analysis following Sites or monitoring stations were established and monitoring timing was between 6.00 am to 9.00 pm (Day time) and (9.00 pm to 6.am night).

1. Partially crowded area, 2. Highly crowded area 3. Medium crowded area 4. Industrial area 5. Big Industrial area and 6. Outskirt of city. During day time analysis all the monitoring stations 1 to 7 show values between 77.50 db to 87.46 db. This indicates that all monitoring stations are exceeding ambient noise level standards.

In night time also, values at site 2 and site 5 are found to be 71.51 db and 79.32 db respectively.

Site 7 which is mixed zone shows noise level of 84.61db in day time which is attributed to overcrowding & heavy vehicular traffic.

Table 7 shows Noise level monitoring analysis in the city recorded at sampling stations 1. Partially crowded area 2. Highly crowded area 3. Medium crowded area 4. Industrial area 5. Industrial Estate and 6. Outskirt of city. Table 8 shows Ambient Air Quality standards in respect of Noise, 2000Figure 8 shows Equipment used in the analysis CE 8928 digital sound meter.

Table 7
Noise level monitoring analysis

Site No.	Sampling Station	Area use	Noise level db (Avg.) 6.00 am to 9.00 pm.	Noise level db (Avg.) 9.00 pm to 6.00 am.
1	Educational	Sensitive	81.12	54.10
2	Crowded area	Commercial	83.33	71.51
3	Offices and shops	Commercial	82.42	52.13
4	Industrial	Industrial	86.92	69.20
5	Industrial	Industrial	87.46	79.32
6	Apartments	Residential	77.50	42.17
7	Mixed zone	Sensitive	84.61	43.20

Fig. 8: Equipment used in the analysis CE 8928 digital sound meter

Table 8
Ambient Air Quality standards in respect of Noise, 2000

Sr. No.	Area	Leq dB (A)	
		Day Time	Night Time
1	Industrial Area.	75	70
2	Commercial Area.	65	55
3	Residential area.	55	45
4	Silence Zone **	50	40

Note: -1. Day time shall mean from 6.00 a.m. to 10.00 p.m., 2 Night time shall mean from 10.00 p.m. to 6.00 a.m.. 3.Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones, which are declared as such by the competent authority. 4. Mixed categories of areas may be declared as one of the four-abovementioned categories by the competent authority. *dB (A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A “decibel” is a unit in which noise is measured. “A” in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. Leq: It is an energy mean of the noise level over a specified period.

V. RESULTS AND DISCUSSION

5.1 Air Pollution

Major sources are due to emission of chimney gases & automobile emissions. Gases like SO_2, NO_x & fly ash nuisance are more common in City. Industry should go for devices like wet scrubbers to reduce fly ash nuisance. Similarly process industry can make use of fuel gases for neutralization of alkaline effluent. Some of the units should increase the chimney heights. Solar heaters be used for obtaining hot water up to 60-70^{0}C. Traffic jamming to be avoided. Use of chlorine gas has to be banned, instead peroxide bleaching be adopted. To overcome the problem of dust & fluffs, humidifier must be used by the power loom sheds. Non-conventional energy sources are to be tapped.

5.2 Transport and Air Pollution

There has been significant increase in number of vehicles in City. The extent of pollution by these automobiles depends on engine design, fuel consumption, operating conditions.

5.2.1 Long Term Goals

There is need to have an ambient air quality monitoring station in City.

5.2.2 Short Term Goals

Regular analysis & monitoring of various parameters such as SPM, RSPM, SO_2, NO_x, should be carried out at various points in the city and these values should be displayed on boards at various traffic junctions. Measures to keep these values on lower side should

also be highlighted. Use of CNG based vehicles be encouraged. Entry of old diesel-based vehicles be restricted in commercial areas. Use of unleaded petrol be promoted. To reduce traffic jamming measures like road widening be taken.

5.3 Noise pollution

Noise levels in City are at higher side in some residential, commercial and in almost all sensitive areas. There has been increase in the noise levels at all the sites as compared to last year. Measures recommended are –

1. Areas up to 100 meters around certain premises like hospitals, educational institutes, courts be declared as silence zones and honking of vehicle, horns, use of loud speakers, bursting of crackers should be banned in these zones.
2. Avoid traffic jamming.
3. To explore possibility of diverting some of the traffic.
4. Use of earplugs or similar devices be made compulsory for laborers working in industries, which record higher noise levels.

Measures recommended to reduce noise levels in textile industry –

1. Noise control by location – Noisy machines can be segregated (e.g. compressors) & machines having equal level of noise can be clubbed together.
2. Noise reduction by lay out, segregation of areas or dividing areas by thick walls, avoiding permanent openings etc.
3. Proper maintenance.
4. Incorporation of individual spindle drive in place of belt drive, use of improved bearings, reduction in vibrating parts, elimination of cams, use of electronic controls in place of mechanical controls etc., can reduce the noise in spinning mills.
5. No permission should be granted for starting a power loom shade in residential areas. Instead, efforts be made to persuade power loom owners to shift to industrial area.

VI. CONCLUSION

The most effective method to control air pollution is to stop the formation of pollutants at their emission at the source itself. In case of industrial contaminants, the designing and development of plants may be so selected so as to have minimum pollution. In the present investigation it is observed that sampling sites were exposed to noise as well as pollution level as compared to National Ambient Air Quality Standards Central Pollution Control Board and The Noise Pollution (Regulation and Control) Rules, 2000 Published in the Gazette of India. To reduce noise pollution numerous measures can be employed such as suitable maintenance of vehicles and roads, plantation of trees noise level reduction in textile industries. Vehicular traffic should be maintained effectively by traffic police and to aware the people about noise pollution.

VII. REFERENCES

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