Urbanization and its Impact on the Health and Disease Pattern in Delhi

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Abstract

Urbanization is the process of becoming urban. Initially industrialization and technological development lead to urbanization. Once the process of urbanization started in a particular region it further accelerates to industrialization. In India the process of urbanization started a little late in comparison to West as in 1901 0nly 11.40 per cent of the total population was urban. In India urbanization gain pace only after independence as unban population become 28.53 per cent according to 2001 census. This urban population further increased to 31.16 per cent as per the 2011 census data.

Delhi has witnessed a phenomenal growth in the urban population during the last few decades. From the population of 4, 05,819 in 1901, its population has grown to 13,782,976 in 2001. There was a rapid increased in the population after independence. The 1941-1951 decade recorded a growth of 90 per cent. Since 1951, the population of Delhi has been increasing at an average rate of 50 percent every decade.

As it is evident from the various sources that with increase rate of urbanization the pollution level also increases which lead to various health problems among the residents of the urban areas particularly big urban centers. Looking at this aspects present paper tries to analyze the increase in the air and water pollution in Delhi and its impact on the disease pattern and health of the people. The paper also look at the current health infrastructure of Delhi and also tries to suggest certain measures to improve the health of the people while having a check on the air and water pollution.

KEYWORDS: Population, Health, Disease, infrastructure, Urban, Pollution, Urbanization.

Introduction:

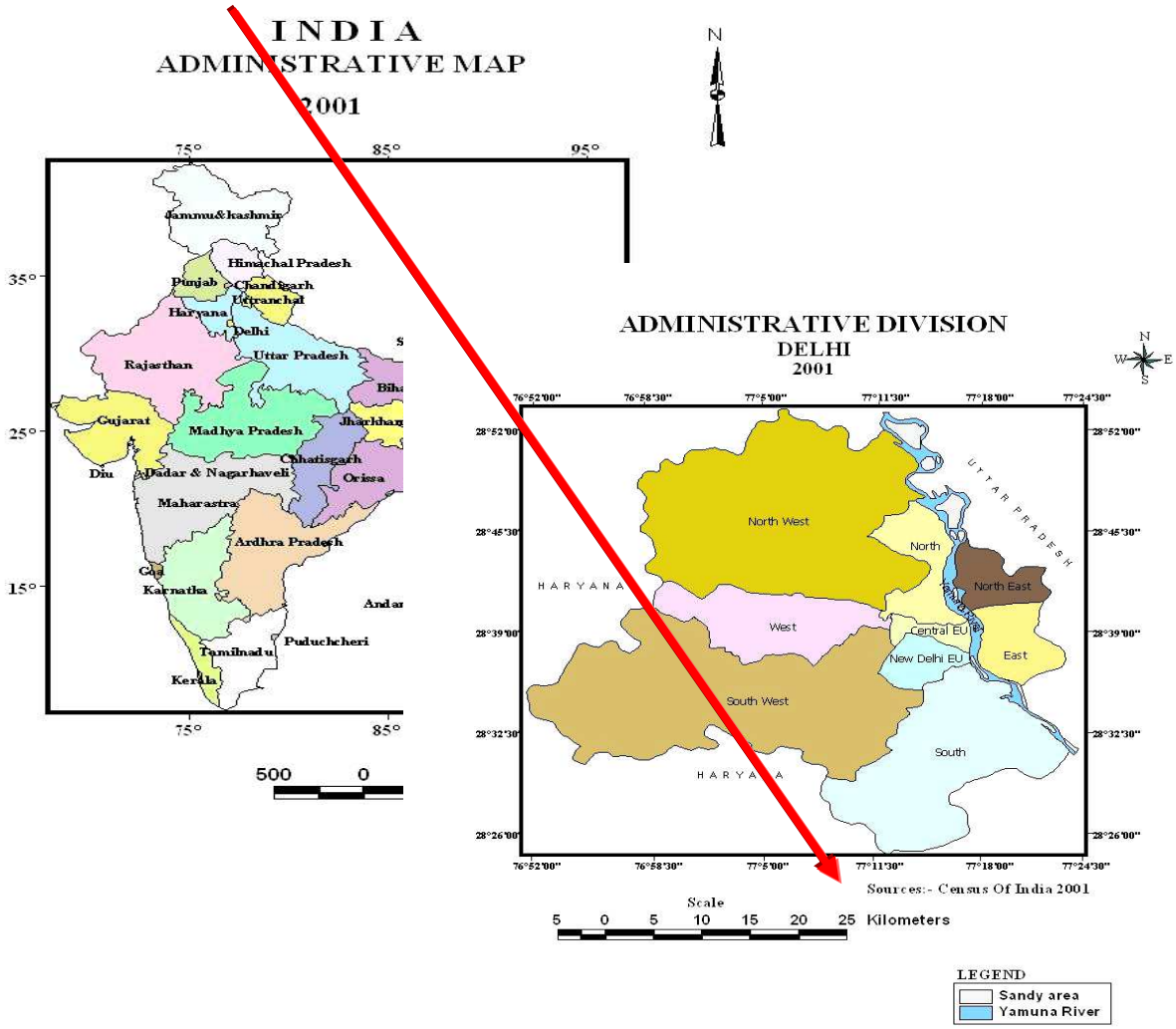
With rapid increase in urbanization coupled with high density of population Delhi has faced a number of serious urban environmental problems like air pollution, water pollution, noise pollution, solid waste generation and sanitation problems. Due to its ever increasing population growth and massive infrastructural development, there is an increased risk of health on the urban residents and a large number of diseases came up which possess a great threat to their life. Urbanization is a sign of progress and development but it also has its adverse impact on the health of the people. When the quality of urban environments deteriorates in terms of air, water, noise and solid waste it could lead to serious health hazards. Of course there are lots of problems created by urbanization especially in developing countries like India and Delhi in particular; this study will focus mainly on the health impact of urbanization in Delhi.

Delhi is the capital of India, situated in northern India and stands on the west bank of Yamuna River bounded by Uttar Pradesh in the east and on the north, west and south by Haryana. Delhi is spread over an area of 1483 sq. kilometers, 216 meters above sea level and has a population of around 14 million. Delhi lies between 28º61’N and 77º23’ in the

northern India. Delhi is the fifth most populated urban area in world with satellite towns like Faridabad, Grogram and Noida making it a NCR, called the National Capital Region. NCR was developed because Delhi needed room to expand and bear the burden of increasing growth and development in the region. Delhi has the advantage of its cosmopolitan society where there are people from every nook and corner of India. This makes the city very multi linguistic and multi cultured.

Study Area:

Delhi, the capital city of India is a home of about 18 million population (2010) in an area of about 1483 sq kilometers (table 1). it is situated at an altitude of 213-305 m over the sea level in the center of the great North Indian Plain. It is an union territory and is located in the north India. Delhi lies between 28º61'N and 77º23' in the northern India. It is completely in the Gangetic Plains. Delhi is the fifth most populated urban area in world with satellite towns like Faridabad, Gurgaon and Noida making it a NCR, called the National Capital Region.



Objectives

To study the levels of urbanization and its impact on health and diseases pattern of Delhi, the following objectives have been framed:

1. To assess the pattern and levels of urbanization in Delhi
2. To study the development pattern in Delhi.
3. To assess the health and diseased pattern in Delhi
4. To assess the impact of urbanization with respect to air pollution, water pollution, solid waste and sanitation condition

Hypothesis

1. High growth of urban population leads to increased urban pollution.
2. Increasing urban pollution poses serious health hazard to the urban dwellers
3. There is a direct relationship between urban pollution and health and diseases condition of urban population

Data and Methodology

Keeping in view the importance of the topic under study, it is preferable that one should conduct a relevant survey to obtained and collect primary data. However, it is difficult to conduct field survey due to time and resources constrain. Therefore, most of the data have been collected mainly through secondary sources such as central pollution control board, survey of India, socio-economic survey of Delhi, economic survey of Delhi and Delhi statistical handbook.

Literature review

Urbanization is an index of transformation from traditional rural economies to modern industrial one. It is progressive concentration (Davis, 1965) of population in urban unit. Quantification of urbanization is very difficult. It is a long term process. Kingsley Davis has explained urbanization as process (Davis, 1962) of switch from spread out pattern of human settlements to one of concentration in urban centers. It is a finite process- a cycle through which a nation pass as they evolve from agrarian to industrial society (Davis and Golden, 1954). He has mentioned three stages in the process of urbanization. Stage one is the initial stage characterized by rural traditional society with predominance in agriculture and dispersed pattern of settlements. Stage two refers to acceleration stage where basic restructuring of the economy and investments in social overhead capitals including transportation, communication take place. Proportion of urban population gradually increases from 25% to 40%, 50%, 60% and so on. (Datta,2006).

In cities like Mumbai, the urbanization process is coupled with industrialization and followed by rapid economic growth. As explained by Bai (2001), in this process, words like ‘‘change’’ or ‘‘growth’’ can describe the situation far more adequately than ‘‘equilibrium’’ which makes the dynamic viewpoint an inevitable feature in dealing with the urban environment and its management.

It is well known that the health effects associated with the airborne particles are dependent on their toxicity. The extent to which air borne particles penetrate into the human respiratory system is mainly determined by the size of the penetrating particles (Balachandran et al. 2000). There are several epidemiological studies present in the literature (Dockery 1993; Hoek et al. 1997; Harrison and Yin 2000; Sammet et al. 2000), which have demonstrated a direct association between atmospheric inhalable particulate matter and respiratory diseases, pulmonary damage, and mortality especially in the urban areas. Therefore, the estimation of the levels of respirable particulate and its major toxic constituent lead (Pb) present in the urban atmosphere is a prime requirement of epidemiological investigation, air quality management, and air pollution abatement (Chow et al. 2002; Querol et al. 2001). For this purpose, we have monitored the levels of particulate matter less than or equal to 10 μm (PM10) and Pb. In addition, we have modeled the dispersion of PM10 over Madurai, the second largest city in the state of Tamil Nadu, India. The measurements (sample collection) and chemical analysis were made using the standard method recommended by the Environmental Protection Agency (EPA), USA, for the period of 1 year viz. July 2005 to June 2006. To investigate the dispersion of pollutants over Madurai city, we have used AERMOD model (EPA 2005; Cimorelli et al. 2005; Kesarkar et al. 2007) developed by EPA. The results obtained from the monitoring of PM10 and Pb along with modeling of PM10 is presented in this investigation.

The twentieth century witnessed a rapid shift of population from rural to urban areas in most of the countries of the world. A merely 13 per cent of the global population lived in urban areas in 1900, which increased to 29 per cent in 1950 and to about 50 per cent by the close of twentieth century (U.N. 2006). However, the pattern of urbanization is to be seen very unequal between the developed and developing countries. Majority of the population of developed countries lives in urban areas compared to the majority living in rural areas in the developing countries. On the other hand, most of the urban population of developing countries is concentrated in Asian and African countries. In Asia, most of the South Asia is more rural with lower levels of per capita income than others. Not surprisingly, therefore, the pace of urban change in the south Asian region has been relatively modest, yet urbanization presents enormous challenges due to extreme poverty and lack of urban services (Cohen 2004).

Historically, the process of urbanization speeded up in the wake of industrial revolution in the western world leading to the expansion of infrastructure such as transport and communication, which propelled increased rural to urban migration. The agglomeration of population, predominance of non-agricultural activities and better provision of social amenities including health and educational infrastructure emerged as distinguishing features of settlements following the industrialization of agrarian economies. In the contemporary times, however, the settlements have become increasingly complex. Thus, in the study of urbanization it is pertinent to know how urban areas are defined because, from the demographic point of view, the level of urbanization is measured in terms of percentage of population living in urban areas (Davis 1962).

Air pollution is recognized as a major threat to human health. The United Nations Environment Programme has estimated that globally 1.1 billion people breathe unhealthy air (UNEP, 2002). Epidemiological studies have shown that concentrations of ambient air particles are associated with a wide range of effects on human health, especially on the

cardio-respiratory system (Bates, 1992; Dockery and Pope, 1994). A growing body of evidence indicates that particulate pollution increases daily deaths and hospital admissions throughout the world (Pope et al., 1995; Zanobetti et al., 2001). Gaseous co-pollutants, seasonal patterns or weather did not confound the association between particulate pollution and cardiopulmonary mortality (Schwartz, 1994; Samet et al., 1998, 2000). Similarly, it was not modified significantly by race, sex and socioeconomic status (Zanobetti and Schwartz, 2000c). Thus, the association between particulate air pollution exposures and cardio-pulmonary mortality appeared causal.

Sulfur dioxide (SO_2) is emitted in direct proportion to the amount of sulfur in fuel. Coal burning is a major source of SO_2 in air. It is an acidic gas, which combines with water vapor in the atmosphere to produce acid rain. SO in ambient air can also affect human health (2 Routledge et al., 2006), particularly in those suffering from asthma and chronic lung diseases and exacerbates respiratory symptoms and impaired breathing in sensitive individuals (Lipfert, 1994). It can also attach to particle surfaces and may form acidic coatings. It is considered more harmful when particulate and other pollution concentrations are high.

Globally, available knowledge on many health impact-exposure connections calls for global exchange of experience on some of the well-known issues on environmental health, like e.g.: Airborne lead exposure mainly from petrol products is resulting in lead-induced deficits in children's intelligence; the expanding use of automobiles is increasing mortality and morbidity due to car accidents; heat waves in large cities particularly place elderly people at risk; indoor air pollution mainly from the use of solid fuels is a major risk factor in cities in the developing countries (Smith 2000).

A detailed study (Das and Hammer, 2007) of quality of care provided by private and public medical practitioners across seven (rich and poor) neighborhood in Delhi, India, found that the poor 'receive low-quality care from the private sector because doctors do not know much and low-quality care from the public sector because doctors do not do much. Indeed, in poor neighborhood, despite the lower competence of providers in the private sector, the quality of advice that patients receive compares favorably to the public sector: households in poor areas are better off visiting less qualified private providers than more qualified public doctors'.

Impact of Urbanization on the Health Status and Disease Pattern

It is commonly agreed that pollution is, without doubt, the outcome of urban industrial and technological revolution and rapacious and speedy exploitation of natural resources, increased rate of exchange of matter and energy and ever increasing industrial wastes, urban effluents and consumer goods.

Air pollution and its Impact on Health

According to WHO, "Air pollution is defined as limited to situation in which the outdoor ambient atmosphere contains materials in concentration, which are harmful to man and his surrounding environments" The major air pollutants in Delhi are SO2, NO2, SPM and RSPM.

Sources of air pollution in Delhi

Vehicular emissions, industrial emissions, household activities are the major source of air pollution in Delhi (Balachandran et al., 2000).

(a) Vehicular pollution: motor vehicles in Delhi

As in case of many other Asian cities, motor vehicles are responsible for a substantial part of Delhi's air pollution. Delhi with only a little over 1% of India's population, accounts about 8% of the national motor vehicles (Badami, 2005). The motor vehicle fleet presently stands at 4.2 million; of these 2.7 million are two wheelers (Badami, 2005). Currently vehicular pollution contributes to 72% of the total air pollution load in Delhi (Goyal et al., 2006), which was only 23% in 1970-71. It has been estimated that vehicular source is responsible for generating more than 3000 metric tons of pollutants per day (MT /day) in Delhi.

Table 1: Relative contribution to air pollution in Delhi

Source	**Year**			
	1970 – 71	1980 - 81	1990 - 91	2000 – 2001
Vehicle	23%	42%	63%	72%
Industry	56%	40%	29%	20%
Domestic	21%	18%	8%	8%

Sources: Central Pollution Control Board (CPCB)

Since the time of economic liberalization policy introduced by the Government of India, more and more households have graduated to higher income categories. Coupled with changing attitudes towards taking loans, people no longer found it difficult to own their personal car. Sales of passenger cars jumped more than three times from 209,203 units in 1994 to 638,815 units in 2000 - all in a matter of seven years. The National Capital Region of Delhi has the highest number of vehicles in the country - more than Mumbai, Calcutta and Chennai put together.

There has been a steady increase in the number of vehicles in Delhi and their contribution to city's air pollution in the last three decades. Till 1990, the rise in the number of motor vehicles in Delhi was proportional with the population growth. Thereafter, the growth of vehicles has been spectacular, surpassing population increase by several folds. The population of the city has increased from 3.53 million in 1970 to 13.80 million in 2001, registering a rise of 3.9-fold over a period of 30 years. On the other hand, the number of registered motor vehicles in the city in 2001 was 34.2 lakh against 2 lakh during 1970-71. The growth in the vehicular population of the city during this period, however, has been 17-fold that far surpassed population growth. In 1975, the number of vehicles in Delhi and Mumbai was almost the same. Today Delhi has 3 times more vehicles than Mumbai, although Mumbai has 4 million more inhabitants than Delhi. In 1995 Delhi had 27 lakh vehicles compared with 7.2 lakh in Mumbai, 5.6 lakh in Kolkata and 8.1 lakh in Chennai. In essence, within a span of just 30 years (1971-2001) the city has 3.9-times more residents and 17-times more vehicles. It has been projected that the gap between the growth in human and vehicular population in Delhi will further widen in future.

(b) Industrial source of air pollution in Delhi

The share of industries as source of air pollution is rapidly declining in Delhi for the past thirty years. For example, during 1970-71, industrial pollution was the biggest contributor (56%) to city's air pollution load. In contrast, only 20% of Delhi's air pollution is now generated by the industries, mainly the three coal-based thermal power plants at Indraprastha, Badarpur and Rajghat.

(c) Domestic source

Like the industries, the contribution of household sector to city's air pollution is steadily declining. Now a day only 8% of Delhi's air pollution is contributed by household sources, compared with 21% in 1970-71 and 18% in 1980-81. Pollution from household sources is mainly due to the use of coal, kerosene and unprocessed solid biomass like firewood, cow dung and agricultural refuse like hay, husk, dried leaves etc.

Ambient Air Quality Monitoring in Delhi

Data on the concentration of ambient air pollutants with respect to RSPM (respiratory particulate matter with an aerodynamic diameter of less than 10 µm.), carcinogenic organic compounds like polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs), oxides of nitrogen (NOx), sulfur dioxide (SO_2), suspended particulate matter (SPM) and ozone in study areas were obtained from different air quality monitoring stations operated under National Air Quality Monitoring Programme (NAMP). Central Pollution Control Board and National Environmental Engineering Research Institute (NEERI) operate these stations under NAMP at the following locations as mentioned in Table 2.

Table 2: Air Quality Monitoring Stations in Delhi

Name		**Area**	**Operated by**
1	Ashok Vihar	North	CPCB
2	ITO	Central	CPCB
3	Nizamuddin	South-east	CPCB
4	Shahadara	North-east	CPCB
5	JanakPuri	West	CPCB
6	ShahzadaBagh	North	CPCB
7	Siri Fort	South	CPCB
8	Sarojini Nagar	South	NEERI
9	Town Hall Library	North	NEERI
10	Mayapuri Industrial Area	West	NEERI

Sources: CPCB, 2008

Results and Discussions:

(a) Suspended Particulate Matter (SPM)

The concentration of SPM in Delhi's air had varied between 300 and 409 µg/m^3 from 1989 to 2005. All through these years the SPM level exceeded National Ambient Air Quality Standards (NAAQS) in residential areas.

(b) Respirable Suspended Particulate Matter (RSPM/PM_{10})

RSPM levels at various monitoring stations are given in Table 4.3. Out of the 10 air quality monitoring stations operative in Delhi, 6 were located in residential areas. The mean annual average respirable suspended particulate matter (RSPM) level during 2002-2005 in these areas of Delhi was 142 µg/m^3, which exceeded NAAQS. RSPM levels at various monitoring stations and areas are depicted in table 4.3. Among the residential

areas, highest RSPM concentration was reported at Town Hall (4-year mean 178 μg/m^3), followed by Sarojini Nagar (155 μg/m^3) and Janakpuri (141 μg/m^3).

Table 3: Respirable suspended particulate matter (RSPM) concentrations (μg/m^3) in Delhi's air during 2002-2005

Area	**2002**	**2003**	**2004**	**2005**	**4-yr (Mean ± SD)**
Residential and other areas					
Ashok Vihar	147	132	137	113	132 ± 14
Siri Fort	138	110	127	111	122 ± 13
Sarojini Nagar	167	166	151	137	155 ± 14
Janakpuri	152	137	141	134	141 ± 8
Nizamuddin	133	127	133	100	123 ± 16
Town Hall	190	189	167	167	178 ± 13
Mean ± SD	155 ± 21	144 ± 29	143 ± 14	127 ± 24	142 ± 11
Industrial area					
Mayapuri	NA	212	213	233	219 ± 12
ShahzadaBagh	186	151	138	130	151 ± 25
Shahdara	153	136	131	131	138 ± 10
Mean ± SD	170 ± 23	166 ± 40	161 ± 45	165 ± 59	165 ± 4
Traffic intersection					
ITO	270	244	228	259	250 ± 18
Overall	171 ± 42	160 ± 42	157 ± 36	152 ± 53	160 ± 8

Sources: CPCB, 2008

Air Quality

The Central Pollution Control Board has been monitoring ambient air quality at seven locations in Delhi for the past several years. The locations have been categorized based on land use, viz. residential, industrial and traffic intersection. The ambient air quality status has been compared with the air quality status during year 2007. The sulphur dioxide concentrations have shown an increasing trend at residential and industrial areas during year 2008 and decreasing trend at traffic intersection with respect to air quality status during year 2007. All the values recorded have been well below the prescribed National Standard. Annual average concentration of nitrogen dioxide during year 2008 decreased in traffic intersection, whereas increased in residential and industrial areas in comparison to year 2007 and all the values have been within the prescribed National Ambient Air Quality Standard. Annual average SPM concentration during year 2008 registered a decrease of approximately 3 percent at traffic intersection, whereas increase at residential areas and industrial areas. RSPM recorded an increasing trend at residential and industrial areas during year 2008. Carbon Monoxide levels measured at Bahadur

Shah Zafar Marg traffic intersection during year 2008 was found as 2249 $\mu g/m^3$ as against 2463 $\mu g/m^3$ recorded during 2007, thus indicating a decline of 8.7 percent.

Table 4: Ambient Air Quality Trends in Delhi

Parameter	**Percent increase/decrease during year 2008 with respect to year 2007**	
	Area	**Increase / Decrease**
Sulphur Dioxide (SO_2)	Residential	(+) 25%
	Industrial	(+) 25%
	Traffic Intersection	(-) 12.5%
Nitrogen Dioxide (NO_2)	Residential	(+) 25%
	Industrial	(+) 28.6%
	Traffic Intersection	(-) 18.1%
Suspended Particulate Matter (SPM)	Residential	(+) 15.2%
	Industrial	(+) 12.5%
	Traffic Intersection	(-) 3%
Respirable Suspended Particulate Matter (RSPM)	Residential	(+) 24.5%
	Industrial	(+) 24.7%
	Traffic Intersection	No change
Carbon Monoxide (CO)	Traffic Intersection	(-) 8.7%

Sources: CPCB, 2008

Health Effects of Air Pollution

Air pollution is recognized as a major threat to human health. The United Nations Environment Programme has estimated that globally 1.1 billion people breathe unhealthy air (UNEP, 2002). Epidemiological studies have shown that concentrations of ambient air particles are associated with a wide range of effects on human health, especially on the cardio-respiratory system (Bates, 1992; Dockery and Pope, 1994). A growing body of evidence indicates that particulate pollution increases daily deaths and hospital admissions throughout the world (Pope et al., 1995; Zanobetti et al., 2001). Gaseous co-pollutants, seasonal patterns or weather did not confound the association between particulate pollution and cardiopulmonary mortality (Schwartz, 1994; Samet et al., 1998, 2000). Similarly, it was not modified significantly by race, sex and socioeconomic status (Zanobetti and Schwartz, 2000c). Thus, the association between particulate air pollution exposures and cardio-pulmonary mortality appeared causal.

Table: 5 Health Effect of Air Pollution

Pollutant	Source	Effect on human health
Carbon Monoxide	Incomplete fuel combustion (e.g. two-stroke engine)	Fatal in large does: aggravates heart disorders; effects central nervous System; impairs oxygen carrying capacity of blood
Sulphur	Burning of sulphur containing fuel	Affects the functions of lungs

dioxide	like coal in power plants and oil by vehicles	
Suspended Particulate matter	Smoke from domestic, industrial and vehicular sources	Small particles are poisonous. They are carriers of carcinogenic tracer elements
Nitrogen oxides	Fuel combustion in motor vehicles, power stations and furnaces	Affects the respiratory system, Irritation of respiratory tract
Volatile hydrocarbons	Partial combustion of carbonaceous fuels (two stroke engines, industrial processes, disposal of solid wastes)	Drowsiness, eye irritation, coughing
Oxidants and Ozone	Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons	Causes increased sensitivity to infections, lung diseases, irritation in eyes, nose and throat, risk asthmatics, children and those involved in heavy exercise
Lead	Emissions from motor vehicles	Nervous system slow down and brain development is retarded
Aldehydes	Chemicals	Irritation of eyes, nose, throat,sneezing,coughing, nausea, breathing difficulties, carcinogenic in animals

Sources: Compendium of environment statistics, 1998 and 1999

Water pollution and health impacts

According to World Health Organization (WHO) water pollution may be define as " foreign materials either from natural or other sources are contaminated with water supplies and may be harmful to life, because of their toxicity, reduction of normal oxygen level of water aesthetically unsuitable effects and spread of epidemic diseases"

Sources of water pollution

Water pollution comes from three main sources:

1. domestic sewage,
2. industrial effluents and
3. runoff from activities such as agriculture.

Water pollution from domestic and human wastewater causes many severe water borne diseases. The problem of water pollution due to industries is because of the inadequate measures adapted for effluent treatment than to the intensity of industrial activities. The quantity of sewage and liquid wastes from human settlements and uncontrolled industries generated by Delhi now far exceeds both the city's wastewater treatment capacity and carrying capacity of its sewers. The water quality is affected due to the inadequate availability of basic facilities and rapidly increasing population.

Water Quality Assessment Parameter:

i. physical
ii. Biological

iii. Chemical

Physical parameters used to ascertain the quality of water include temperature, colour, turbidity etc.

Table: 6 Health effect of water pollution

Pollutants	Health effect on human
Mercury	Abdominal pain, headache, diarrhea, hemolysis, chest pain.
Lead	Aneaemia, vomiting, loss of appetite,
Arsenic	Disturbed peripheral circulation, mental disturbance, liver cirrhosis, kidney damage.
Cadmium	Diarrhoea, growth retardation, bone deformation, kidney damage.
Copper	Hypertension, uremia, coma, sporadic fever.
Barium	Vomiting, paralysis.
Zinc	Vomiting, renal damage
Selenium	Damage of kidney and spleen, vomiting, low blood pressure, can cause even death.
Hexavalent Chromium	Nephritis, cancer.
Cobalt	Diarrhoea, bond deformities, paralysis.

Source: CPCB, 2008

CONCLUSION AND SUGGESTIONS

It is very difficult to predict the future level of urbanization for a country like India because level not only depends upon demographic trends, but economic and political factors as well. Further, the contribution of migration remain stable around one fifth of the urban growth in the last several decades. If the processes of urbanization and population growth in Delhi remains uncheck, the number of pollution and diseases will increase accordingly which will have adverse effect on human beings as well as plants and animals. At present the government is not able to provide the required amount of health facilities and infrastructure. According to WHO, the minimum requirements of beds per 1000 population is 5 while Delhi has 2.14 beds per 1000 population which is quite low. So, to attain urbanization with better health facilities Delhi has a long way to go and the government has to rely on private health institutions as well.

There has been rapid expansion of Delhi in Recent times. Therefore the number of air quality monitoring stations should be increased from the present 10 to keep pace with the city's growth. More stations are needed particularly in hotspot area where vehicle and industrial emissions are high. Similarly, monitoring stations with low background air pollution level such as extreme south of the city may be considered. Besides increasing the number of the monitoring stations, the performance of the existing monitoring station should be overhauled and streamlined ensuring strict quality control. It should be ensured that all CPCB and NEERI are operational for sampling for a mandatory minimum period of 104 days/year.

Urban air pollution causes five times as many deaths and illness as malaria and is the largest contributor of regional burden of diseases in India. Information collected suggested that the main air pollutant of concern of public health in India is the particulate matter. The state and central pollution control boards may continue to collaborate in monitoring the various urban pollutions and their health impacts studies. Whenever necessary, they may continue to invite expertise from the universities, basic and bio-medical institutes, non-government organizations and private consultants.

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