

Climatic changes in Indore with reference to solid waste management & air pollution

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Abstract

In today's context we have noticed that there are lots of solid wastes by which our environment is effecting. For the analysis of these effects we have taken our city (Indore) for the same analysis. And find that as the population is increasing the rate of solid waste is increasing. And the air is very much polluted because of more traffic. So we have taken the Indore municipal Corporation data for our analysis on environment. The ongoing Solid Waste Management problem is a very acute in nature. At this point of time even its effects are so hazardous that we cannot afford to ignore it anymore. As discussed before, the waste accumulated at various parts of our country would not only directly affect the nearby population but will also have a major role in climate change which could in turn give way for some very contagious and harmful diseases.

Keywords: Solid waste management, climatic changes, environmental hazards, etc.

1. Introduction

It is estimated that out of total solid waste generated every day in the urban centers of India at present about 60% of generated are disposed of safely. The uncollected solid waste remains present in and around the locality or find its way into the open drains. Proper solid waste disposal is also hampered by the non - availability of suitable land fill site, partly due to the high land costs and partly due to rapid growth.

According to the survey carried out by CPCB in 1998 it has been observed that the total quantity of solid waste generate by 23 metro cities of India is about 30, 058 tons

per day of solid waste. The per capital waste generation in small, medium and large cities/towns about 0.3kg and 0.4 kg and 0.5kg respectively. Because of this fact management of solid waste is primarily an urban issue in country like India. In urban areas the responsibility of solid waste management lays exclusively with the urban local bodies that is municipal governments. However the municipalities of most states in India are statutory responsible for collecting Garbage from the households. They usually perform the third and fourth stages of the SWM function. But the households perform the first two and different arrangements are followed to accomplish the task. In many cases where residents are economically better off and environmentally conscious, community organizations are coming forward to handle at least the door-to-door collection. Even though such initiatives are still at nascent stage they are slowly gaining momentum and may assume a major role in future.

There is one stage between the collection and disposal of solid waste, that is, resource recovery or segregation of degradable and recyclable materials in the garbage and actual recycling. In no Indian city is the separation of garbage between degradable and non-degradable items and recycling taken up at the municipal level. This is so, not only because it is uneconomical since only 13 to 20 % of municipal waste is recyclable the remaining 80-85% is compost able/inert, but is also extremely labour intensive. In most cases however, secondary waste collection is not being done adequately. On an average, 20 to 30 percent of the total waste generated remains uncollected, creating environmental hazards in urban settlements.

Now a days due to increase in the environmental concern, emphasis is laid on recycling and reuse of

domestic garbage is gaining momentum. The municipalities and municipal corporations themselves are unable to take up such projects of collection, segregation and recycling or composting in an integrated manner because of the high cost involved. But NGO's and many private agencies are now providing these services to the municipalities or are independently running some projects for waste collection, segregation, recycling and composting or even bio-gas generation.

Solid waste management usually refers to the collection, transfer, recycling, resource recovery (composting waste to energy, etc.) and disposal of municipal solid waste, "Municipal solid waste is again defined to include refuse from households, solid waste from industrial and commercial establishments, Refuse from institutions, market waste, yard waste and street sweeping (World Bank, 1994).

Management of municipal solid waste involves (a) development of an insight into the impact of waste generation, collection, transportation and disposal methods adopted by a society on the environment and (b) adoption of new methods to reduce this impact. (CPHEEO Manual, Jan. 2000). Accordingly, waste management should be an integrated affair, which must include:

- Minimizing waste,
- Maximizing environmentally sound waste re-use and recycling
- Promoting environmentally sound waste disposal and treatment services

The stages involved in SWM are primarily as follows:

- Primary collection of solid waste from households levels.
- Primary transportation to municipal waste bins and collection points,
- Secondary transportation of garbage from municipal bins to disposal sites

Disposal of the waste.

2. OBJECTIVES

The broad objectives of the Detail Project (DPR) are to determine a technically and economically viable solid waste management project for a phased implementation to meet the requirements of the year 2021. Following are the specific objectives:

- To devise a system of Storage of food/Biodegradable waste as well as recyclable waste separately at the sources of generation of waste.

- To devise cost effective systems for Primary collection of waste from the city in general and from the slums in particular.
- To devise efficient system of day to day cleaning of streets and public places.
- To devise system to eliminate the age old practice of throwing garbage on the streets or outside the dustbins causing nuisance to the people and posing a threat to the health of the community at large.
- To modernize system of wastage storage depots which may synchronize with the system of primary collection as well as transportation vehicles.
- To improve the system of transportation of waste by following the principle of 'handle waste once only.
- To promote processing of waste for deriving Bio-organic fertilizer, reduce quantity of waste going to landfill site, derive income from the processing of waste and help agricultural production.
- To attain Garbage free status with n the city and to develop sustainable and efficient Solid Waste Management System.

3. INTRODUCTION OF CITY (INDORE)

• Preamble:

Indore, the premier city of Madhya Pradesh and Divisional Head Quarter, is situated almost centrally on the fertile Malwa plateau with its cardinal points 22° 43' N latitude and 76° 42' E longitude with an altitude of 550 feet above mean sea level. Indore city is linked by three modes of transportation viz. Road, Rail and Air. Its Regional road pattern fans out in all directions. The National Highway (Mumbai - Agra Road) passes through the city's habited area. State Highways and other roads connect the city with the State Capital Bhopal, all District Head Quarters of the Division and important towns within the District. The city is, served by a broad gauge and meter gauge railway line. The Railway line passes through the heart of the city that forms a physical barrier for inter communications within the city. The city is also served by a regular air service which connects it to Mumbai, Bhopal and New Delhi. Indore is 17th among the 23 million plus cities of India enumerated in the 2001 census. The city is currently the most populated city of Madhya Pradesh. It is the biggest commercial center and is termed as the business capital of Madhya Pradesh.

• **Municipal Corporation Area:**

Total area included within the limits of Municipal Corporation is 130.17 sq.kms. The limits came into force with effect from 8th March, 1982 by special gazette notification. In previous plan the area included in the limits of Municipal Corporation was only 55.80 sq.kms. Today the city is divided into 69 wards. These wards have been clubbed under 12 zones for the decentralization of administration.

• **Planning Area**

Planning area for Indore was notified under sub-section (i) of section 13 of Madhya Pradesh Nagar Tatha Gram Nivesh Adhiniyam, 1973 (no. 23 of 1973) covering 37 villages. The above notified planning area came into effect from 15- 3-74 and the total area covered within planning area was 214 sq. kms. (21410 hectares). The revised planning area of Indore was again notified under sub-section (2) of section 13 of the Act covering total 152 villages (including 37 villages of old planning area) and came in to effect from 25/11/2000. The planning area was again revised and 62 villages were excluded and this revised planning area of Indore was notified under sub-section (2) of section 13 of the Act. This re-constituted planning area, for which the Development Plan proposals are framed, came in to effect from 28/6/2002, and its limits are defined in the schedule given below.

• **Limits of Indore Planning Area**

NORTH : Limbodagiri, Rewati, Alvasa, Baroli, Jakhya, Bhangya, Kailodhala, Talawalichanda, Mangalyasadak, Rahukhedhi, Lasudia Parmar

WEST : Budhanya, Jamburdi Hapsi, Rizloy, Bisnawada, Kalaria, Sinodi, Sindoda, Rangwasa

SOUTH : Rangwasa, Pigdamber, Umaria, Nawada, Palda, Machala, Morod, Umari, Asrawad Khurd, Mirjapur, Ralamandal, Sanawadia

EAST : Sanawadia, Umaria Khurd, Malikhedi, Kanadia, Nipaniya, Mayakhedi, Arandia

Total area covered within above planning area is 504.87 sq. km.

• **Population and area of the City**

The city of Indore has a population of 16.26 lacs and an area of 185.88 sq. kms. The ward - wise population of the city is shown at table. The projected population of the city till 2025 is estimated as under:

Indore	
POP1961 Census	394941
POP1971 Census	537000
POP1981 Census	829327
POP1991 Census	1109000
POP2001 Census	1626297
POP2011 Projected	2104658
POP2021 Projected	2681831
POP2025 Projected	2912701

• **Population Changes**

The study of demographic pattern plays a major role in the preparation of MSW plan. This type of study helps to assess the past and present growth trends and to estimate the future growth. The knowledge of basic demographic trend, in the area to be planned, is very essential to perceive the problems and exact needs of the area. It gives the idea about living conditions of the people and their immediate needs of basic amenities which planner should attend while preparing MSW plan. Therefore, the analysis of demographic factors in relation to various urban functions facilitate the requirement or need for housing, industry, commerce, amenities and recreation.

• **Population Growth**

The population data collected from the year 1971 to 2001 census is presented in Table. This table also shows growth rate of population in percent for periods 1971 - 81, 1981-91 and 1991 - 2001. The percentage increase of population in 1981, over population of 1971 was 53.80%. The population growth from 1981 - 91 was observed as 34.50 % & between 1991 - 01 as 47.90 %.

Table:1 Population and growth rate of Indore Planning Area

Year	Indore Municipal Corporation		Indore Planning Area (IMC+37+53 villages)	
	Population	Growth rate %	Population	Growth rate %
1971	537000		575457	
1981	829327	44.68	884775	53.80
1991	1109000	31.63	1189797	34.50
2001	1626297	41.31	1759532	47.90

• Population Density

The population density of the Indore Planning area as per 2001 census is as high as 1028 persons/ha. Particularly in the CBD area. This figure is too high even when compared to the population density figures of other cities in Madhya Pradesh State and Indore District. Spatial distribution of population density of Indore city, (ward wise) is presented in Figure. From this figure, one can notice that the density is ranging from a meager 100 persons/ha in the peripheral areas to as high as 1000 persons per ha in the core of the city. Therefore, there is tremendous pressure on the existing land and needs to be regularized in the development plan.

• Distribution of Population

Indore, the industrial and commercial capital city of Madhya Pradesh, is experiencing fast growth. Its population has increased from 5.75 lakhs in 1971 to 17.6 lakhs in 2001. In view of the fact that there would be cent percent urbanization in next 20 to 25 years, there would be tremendous pressure on the adjoining productive agriculture land and on other natural resources such as surface water bodies, groundwater prospective zones etc.

	AREA Ha	POP1991 Census	POP2001 Provisional	POP2011 Projected
IMC Area	13017	1091618	1542618	2179873
Old Planning Area (37 villages incl. IMC)	21410	1109000	1626297	2358372
New	50469*	1189797	1759532	2534685

Planning Area (90 Villages)				
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• Topography

Topography of the city is generally flat but there are several hills in the city located around lakes the maximum height of which is 625 Mt. above Mean Sea Level. The Soil information collected from NBSS & LUP, Nagpur has been studied and soil coverage has been created. Each polygon has the information related to the association of soil series. From these soil types, soil depth, soil texture and soil erosion has been separated out and the maps have been prepared separately. The extent and spatial distribution of soil depth, soil erosion hazard and soil texture play an important role in urban suitability analysis.

S. No.	Soil Depth	Area(Ha)
1	Deep	24912.19
2	Very shallow	9749.55
3	River	35.44
4	Water body	838.43
5	Built-up	13558.55
Total		49094.16

• Industrial And Adjoining Areas

The present major industrial area is at Sanwer Road. The major industrial development was envisaged along this road in development plan-1991 also. But due to lack of infrastructure development and establishment of new industrial areas at Pithampur and at Dewas, the Sanwer. The predominant existing industrial areas are mill area near Pardesipura and Pologround. The Pologround shall continue to function. But the mill area is no longer required because almost all the mills are not functioning and lands of some of the mills has been converted to residential / commercial by the Government. Other isolated industries, such as oil and Dal mill at village Chitawad and along Subhash Marg and industries located in existing congested areas of the city, are proposed to be relocated in designated industrial areas. In such case the areas vacated by such industries shall be treated as regeneration areas. An organised industrial area for Dal and oil Mills and other agro-based units is proposed along Deo-guradia road in planning unit No. 7. The industrial units located at Navlakha and other nearby place are to be relocated and accommodated in this area.

Pithampur; Referred to Detroit of India due to heavy concentration of Automobile Industry, is close (25km) to Indore. It has plants of Kinetic Honda, Bajaj Tempo, Eicher Motors, Hindustan Motors, Larson & Tubro, Caparo, Bhaghirath Engineering etc. It has also steel plant of Pratap Steel, Kusum, Prestige and Chirag Ingots. And electronics consumer Greaves, Koras India, Onida Saka etc. are also located.

Dewas another industrial area is close (35km) to Indore. Among the notable industries are Tata Exports, Gajra Group, Steel Tubes, S. Kumar's, Prestige Soya, Ruchi, Ranbaxy Laboratories. And Bank Note Press of the Govt. of India.

Mhow (Military Headquarters of War) established during WW as a base for British troops in India is close (22km) to the city. The latter has a thriving ready-made garment industry as well as shoe and metal cottage industry. Smocking (a type design) dresses Mhow are quite famous.

4. AIR POLLUTION & CLIMATE CHANGES

• Air

A detailed analysis of the environmental conditions of Indore and its effects on the differentiated resident population is presented here. It will help in understanding the rationale for CDP.

The deteriorating air quality is a result of rapid urbanization in which the increase in population density has outstripped the available infrastructure. Vehicular and Industrial pollution is an important aspect. It is indicated by content of suspended particulate matter in the air. The particles are dangerous because they carry a very complex mixture of toxic pollutants. Public health scientists hold that the fine particles from burning coal, petrol, diesel and wood comprising a complex mixture of sulphate, nitrate, ammonium, hydrogen ions, elemental organic compounds, metals, poly nuclear aromatics, lead, cadmium, vanadium, copper, zinc, nickel etc. are harmful chemicals. They coat the surface of the tiny particles present in the air. They believe that even a very small increase in concentration of these particles can cause great harm to lungs and heart and in turn can have effect on the life expectancy.

• Air Quality

The predominant cause of air pollution in the Indore City is Vehicular Traffic. The Madhya Pradesh Pollution

Control Board has undertaken monitoring of various parameters that reflect the pollution levels.

It is observed the Maximum Concentration of suspended particulate matter in some areas of the city of Indore far surpasses the threshold of 200 ug/cum, by the Indian Standard.

Observations

- The value of suspended particulate matter exceeds the prescribed limit of 200ug/m³ in Residential and Commercial Areas on an annual basis.
- Total suspended particulate matters exceed the prescribed standards at all location.
- Concentrations during evening hours were higher.
- Particulate matter concentrations both Respirable and Non-respirable are found to exceed the permissible limits at most of the locations.
- The values of TSPM exceed the limits set by Central Pollution Control Board.

• Solid Waste Management

Collection efficiency - only 70% of the solid waste generated is collected. Many of the wards have frequency of collection more than one day. Some of the reasons for such inefficiency are;

- ✓ Due to poor primary collection
- ✓ Lack of Synchronization Collection, storage transportation of Solid Waste.
- ✓ Inadequate labour (Safai Karmachari's).
- ✓ Storage facility can only store 60% of the solid waste generated.
- ✓ Poor Primary collection of the solid waste generated.
- ✓ Traditional method of treatment of dumping at landfill sites is used.
- ✓ There is 100% efficiency in collection and disposal of Hospital Waste.
- ✓ Hazardous Waste from Industries is collected and disposed.

✓ Environment

✓ Air

- The predominant cause of air pollution in the Indore City is Vehicular Traffic.
- It is observed that the Maximum Concentration of suspended particulate matter in some areas of the city, surpasses the threshold of 200 ug/cum, in many transport corridors of the city.

✓ Water

- Discharge of the Sewers in the flow of Khan River has increased the pollution level of the city.
- The surface water bodies in the city also needs capacity enhancement and control of pollution that can be done in an integrated manner with overall conservation.

✓ Green Cover

- The city lacks in terms of green and recreational areas.

Indore doesn't have any hierarchy of Recreational spaces though it has the micro level neighborhood and housing area parks but very less city parks and no regional park.

5. CONCLUSION

The ongoing Solid Waste Management problem is a very acute in nature. At this point of time even its effects are so hazardous that we cannot afford to ignore it anymore. As discussed before, the waste accumulated at various parts of our country would not only directly affect the nearby population but will also have a major role in climate change which could in turn give way for some very contagious and harmful diseases. Management of solid waste is essentially the duty & responsibility of municipal committees & corporations on India but management of solid waste has been in low on priority of list of municipal authorities & seldom funded adequately. Rules are made for prohibition or prevention of these wastes but however, no provision is made for any kind of imprisonments for their violations. These rules provide only guidelines for obtaining licenses & authorizations, rather than providing any deterrents against defaulters. That is why accidents occur frequently, & hazardous

wastes are occasionally continued to be mishandled & thrown at public places to become a part of municipal solid waste. This is also because these rules do not provide any necessary arrangements for safe collection and disposal of the society's solid waste.

Improper removal & disposal of solid waste, as discussed earlier, is a proven cause of health hazards, which may also cause epidemics, like plague & water borne diseases. The main diseases that can spread out arise from the breeding of rats & flies. It has been estimated that at warm climates, exposed garbage may generate as many flies as up to 25,000 per m² of garbage dump per week (Sources: Sanitary Engineering by S.K Garg). The refuse dump also serves as source food for rats & small rodents, which quickly proliferate & spread to neighboring areas.

Apart from causing diseases the handling & transfer of biological waste pose an infection threat to workers, as well as to those who come in contact with such infected workers. The infections to the workers may pass from the waste through direct contact with the waste, through infection of sores or through vectors. The hazardous wastes thus prove infectious to human health. Some waste may produce acute ill-effects, while others may cause diseases after prolonged exposure. Improper disposals of municipal solid wastes can, thus, cause large scale human deaths, through contamination of water supplies & crops.

The environmental damage caused by solid wastes mostly pertains to aesthetics, & is cause of choking of the storm water drains-leading to rain water stagnation & flooding in case of heavy rains, as happened in Mumbai city in 2005. Uncontrolled dumping of urban refuse eventually destroys the beauty of the country side, as the wastes are taken away by high winds to far& wide. The garbage dumps laying unattended for number of days may also contaminate ground water, as the rain water seeping through the garbage may become poisonous leachate, as it may leach the toxic heavy metallic compounds from the solid wastes. Such leachate may also contaminate surface water sourced, as it may flow along the rain runoff & join the surface sources. In addition, uncontrolled burning of solid wastes may also cause air pollution.

Thus it can be easily concluded that the solid wastes, urban or rural or industrial or municipal, are very harmful to human health as well as the climate too. The rules are proving to be inadequate and so we must take the ultra-necessary steps to at least reduce their effect and maintain ecological balance & human health. Our project is the first step to such necessary projects & though it clearly states how the climate has got affected & continues to get affected by these solid wastes, which in turn affects human health, we now need to start preparing for these changes &

make sure we get adapted to them as soon as possible before it gets too late. Some necessary steps can avoid thousands of deaths of humans & thus make life on this planet easier.

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