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ENVIRONMENTAL STATUS OF MSW DUMPSITES AT BHOPAL AND INDORE (2006-07)



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CENTRAL POLLUTION CONTROL BOARD,
E-3/15, ARERA COLONY, BHOPAL (MP) INDIA

REPORT
ON
ENVIRONMENTAL STATUS OF MSW DUMPSITES
AT BHOPAL AND INDORE
(2006-07)

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Environmental Status of MSW dumpsites at Bhopal & Indore Cities (Madhya Pradesh) 2006-07

1.0 Introduction

In spite of framing the Municipal Solid Waste (M&H) Rules 2000, it is observed that there was a huge gap in implementation of these rules at ground level. There is a critical need to address this gap by bringing together all the concerned stakeholders on a common platform and to explore suitable solutions to arrest the undesirable impact on human health and environment.

Solid waste management is mandatory duty of municipal bodies. This task has gained significant importance with the promulgation of the Municipal Solid Waste (Management & Handling) Rules wherein every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of MSW Rules 2000 and for any infrastructure development for segregation, storage, collection, transportation, processing, and disposal of waste. The municipal bodies are faced with the challenge to meet the compliance deadline put forth in the MSW Rules, 2000 with their limited resources.

The problem of municipal solid waste management has acquired alarming dimensions in country especially over the last decade. Before then, waste management was hardly considered as an issue of concern as the waste could be easily disposed off without any significant impact on environment. However, with the time, due to changing lifestyles of people coupled with urbanization and industrialization the waste characteristics have altered making them little tricky to be managed.

1.1 What should be considered as MSW?

Since the municipal bodies are generally entrusted with the task of management of waste arising within municipal limits, waste of commercial/domestic nature and some times the industrial wastes are included in municipal solid waste. In practice, the untreated biological waste and some of the hazardous industrial waste are also finding their way to the municipal solid waste. However, the rule defines the MSW excluding the industrial hazardous waste and including treated bio-medical waste.

PART - I

Status of MSW dumpsite at Bhopal

2.0 Introduction:

Today, most of the urban centers in India are struggling to come to the terms of acute problems of solid waste management. Due to lack of sincere efforts by municipal bodies, solid waste management has become a tenacious problem and this notwithstanding the fact that the large part of municipal expenditure is allotted to it. Solid waste management is still considered an inferior services and most of the times should be overlooked by municipal bodies and The Bhopal Municipal Corporation is no exception.

MSW generation in Bhopal city is about 600 to 650 TPD, out of which only 60-70 % are collected on daily basis, and rest is left on roads, streets, colony dust bins and drains etc. Urban solid waste generally contains up to 20% of recyclable material, 40-50% waste is compostable material and the rest is mostly inert materials such as sand, debris, dust etc. Municipal solid waste has low calorific value and its average density varies between 500-600 Kg/m³ therefore, power generation by solid waste is not a practical solution in India.

2.1 About Study area:

2.1.1 General information

Area :

285.88 km²

Population :

1.4 million

2.1.2 Solid waste generation

Total generation:

600 ton/day

Waste generation per capita:

0.43 kg/person/day
(157 Kg/Year)

Waste composition:

Approximately 50%
organic

2.1.3 Solid waste management

Collection rate:

60-70%

Recycling:

Carried out by
scavengers

56 wards. After the elections, Dr. R. K. Bisaria was elected as the first mayor.

2.4 Present Scenario

Presently, Bhopal city is divided into 66 Wards and 11 Zones. Elected body has a term of 5 years. The corporation performs its function as per the provision of an Act governing the Municipal Corporations in the State. The administration of the corporation is under the Mayor. The Municipal Commissioner is the CEO, and is a senior State Administrative Service Officer. The Municipal Commissioner is assisted by a work force of municipal officers. For the purpose of SWM activities 2-health officers, assisted by several supervisory staff's as mentioned below are posted:

- (a) Chief Sanitary Inspectors - 4
- (b) Sanitary Inspectors - 16
- (c) Sanitary Supervisors - 60
- (d) Jamadaars - 60

The SWM department of Bhopal Municipal Corporation has the work force of 1900 persons for street sweeping, 300 for transportation and disposal of waste and 580 temporary labours for collection and transportation of waste.

2.5 Number and types of vehicles used for transportation of MSW

S.No.	Type of Vehicle	No.	Capacity Avg. in Tones	Trip per day	Total collection per day
01.	Trucks (mini)	32	3	2	192
02.	T.Trollys	18	2	2	32
03.	Refuse compacters	11	6	2	132
04.	Mini Compacters	02	6	2	24
05.	Dumpers placers each within 5 bins	09	2	2	90
Total					450 tons/day

(Envirotech make APM- 451 Model). Location details of the monitoring stations are given below;

- (1) AAQM-1. Located at the entrance of the MSW dumping site.
- (2) AAQM-2. Located at Rasla-Khedi, Village on Vidisha road on north side of the MSW site.
- (3) AAQM-3. On west side of the MSW site near about 1 Km away from the site at Kheda village near Railway crossing.
- (4) AAQM-4. Located on the south side of the MSW site at Mohali Village near school building, about 1 Km from dumping site.

As mentioned earlier during last 30 years Bhanpura is being used as a trenching ground. Therefore the possibilities of toxic pollutants may percolates to the ground water are high. Six locations were selected for samples collection for various representative parameters to assess present pollution status. Details of the monitoring stations are given below:

- (1) Anganwadi Kendra No.436 in Bhanpura
- (2) Shikhsa Beauty Parlour, Raslakhedi
- (3) Well water of Mohan Singh, Village -Khejda
- (4) Government School, Mohali
- (5) MSW site at Bhanpura
- (6) BMC bore well near People's Hospital

2.8 Material & Methods

Ambient air monitoring was carried out once in a month for two days at four sampling locations. The sampling duration was 8 hours at an average flow rate of $1.1 \text{ m}^3/\text{min}$ for suspended particulate matter and 1 LPM for gaseous pollutants.

The respirable particulate matter was collected on a glass fiber filter paper whereas suspended particulate matter was collected in dust collector. Samples for determination of SO_2 and NO_2 were collected by bubbling air samples in an appropriate absorbing media in impingers at a flow rate of 1 LPM.

Improved West and Gaeke method for SO_2 - The ambient air is absorbed in a solution of sodium tetrachloromercurate and analyzed by

MSW dumpsite, Bhanpura showed maximum concentrations as expected for SPM, RSPM, SO_2 , NO_x , NH_3 , and O_3 during the study period. The biological and chemical processes that occur in open dumps produce strong odour, which pollute all adjacent environment. Fires periodically break out in open dumps, generating smoke and contributing air pollution in the region.

2.9.2 Ground Water Quality

The results of the physico-chemical and biological parameters of ground water in and around the Bhopal Municipal Corporation waste dumpsite were presented in Table -VII. Twelve ground water samples and one surface water from Patra River were collected during the study period. The TDS of the water samples in the study area varied from 774 to 1770 mg/L indicating the ionic contamination of ground water due to MSW dumping. Although there is no specific limit for conductivity, but it indicates the soluble ion concentration of the water. The electrical conductivity of water samples varied from 1060 to 2040 $\mu\text{S}/\text{cm}$.

The pH of ground water samples of the area 7.15 to 8.13, that is from neutral to slightly alkaline. The total hardness of the water was in a narrow range of 420 to 776 mg/L, indicating that the water is slight to moderately hard as per United States Ground Water Surveys (USGS) norms. In the present area the chloride content of the water samples varied from 160 to 310 mg/L, exceeding the limits prescribed in MSW Rule-2000. The recommended content of sulphates in drinking water is in the range of 200 to 400 mg/L and in the study area it was within the safe limit of 7 to 14 mg/L. According to IS-10500, the acceptable limit for Bacteriological contamination indicator (MPN - Most Probable Number) in drinking water is 10 per 100ml of sample. Perusal of the MPN data indicated that all the exceed limits, except control point i.e. Bhopal Memorial Hospital and Research Centre (BMHRC) tube well.

MSW leachate may contain heavy metals finds its way into the underground water, rendering it unfit for drinking. In view of this the Heavy Metals like Nickel (Ni), Iron (Fe), Manganese (Mn), Copper (Cu), Cadmium (Cd), Lead (Pb), Zinc (Zn), Mercury (Hg) and Cobalt (Co) were analyzed in all the ground water samples. Except Fe, Mn, Zn and Cu, other metals were not detected during the study period. Iron ranges between BDL to 0.7 mg/L,

the market area, which results scattering of market waste in open space causing unhygienic conditions in that area.

d. There is no system of primary collection of construction waste. Generally the people disposed off construction waste on the streets or near their building.

e. Segregation of recyclable waste is generally not practiced. Most of the recyclable material is disposed off along with domestic and trade waste. Therefore, recyclable waste is generally found mixed with garbage on the streets, in municipality bins and at dumpsite from where part of this waste is picked by the ragpickers.

f. It was observed that the solid waste was transported from the community bins to the disposal sites by vehicles, which are not designed for the purpose. Furthermore, the disposal of the waste is unplanned and uncontrolled and open dumping is done at landfill sites. Open burning of MSW is a common feature at Bhopal and Indore.

g. Disposal is the last stage of the waste management cycle. The situation here is as grim as in collection and transportation. About 60-70% of the municipal waste collected by the civic authorities is dumped in low-lying areas outside the city limits which have no provision of leachate collection, treatment, landfill gas collection and use. Even dumpsite area is not properly fenced. Rag pickers and animals are freely moved inside the MSW dumpsite.

h. During the study period, it was observed that, the dense smoke coming-out from the dump yard throughout the time (especially in nighttime). In rainy season bad odour and flies create problem in nearby habitations.

i. Open burning of MSW also creates visibility problems for the movement of railway traffic on the trunk route connecting Delhi and road traffic on the busy state highway located next to the site.

Table-I Ambient air monitoring at MSW site at Bhopal (M.P.)
Date : 08.11.2006

S.No.	Time	MSW Site				Rasla Khedi village				Khejda village				Maholi village			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am TO 02.00pm	06	57	56	585	BDL	39	42	341	BDL	25	BDL	306	BDL	19	BDL	222
02	02.00 am TO 06.00 pm	10	71	84		05	27	56		05	39	BDL		BDL	27	BDL	

All values are in $\mu\text{g}/\text{m}^3$

Table-II Ambient air monitoring at MSW site at Bhopal (M.P.)
Date : 09.11.2006

S.No.	Time	MSW Site				Rasla Khedi village				Khejda village				Maholi village			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am TO 02.00pm	09	36	84	952	05	29	35	436	BDL	21	BDL	281	BDL	14	BDL	213
02	02.00 am TO 06.00 pm	13	50	119		08	43	49		05	40	BDL		BDL	23	BDL	

All values are in $\mu\text{g}/\text{m}^3$

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Table-III Ambient air monitoring at MSW site at Bhopal (M.P.)
Date : 20.12.2006

S.No.	Time	MSW Site				Rasla Khedi village				Khejda village				Bhanpura Village			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NO ₂	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am TO 02.00pm	-	-	-	-	BDL	31	49	389	BDL	23	BDL	311	-	-	42	-
02	02.00 am TO 06.00 pm	-	-	-	-	06	45	42	-	BDL	33	BDL	-	-	-	-	-

All values are in $\mu\text{g}/\text{m}^3$

Table-IV Ambient air monitoring at MSW site at Bhopal (M.P.)
Date : 21.12.2006

S.No.	Time	MSW Site				Rasla Khedi village				Khejda village				Bhanpura village			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NO ₂	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am TO 02.00pm	-	-	-	-	06	23	42	449	05	29	BDL	345	---	-	49	-
02	02.00 am TO 06.00 pm	-	-	-	-	08	39	63	-	07	18	BDL	-	-	-	-	-

All values are in $\mu\text{g}/\text{m}^3$

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Table-V

Ambient air monitoring of Ozone at MSW site at Bhopal
(M.P.), Date : 20.12.2006

S.No.	Time	Rasla Khedi	Khejda village	Bhanpura village
01	08.00 am	33	20	--
02	09.00 am	70	28	40
03	10.00 am	121	36	--
04	11.00 am	180	50	--
05	12.00 noon	220	77	161
06	01.00 pm	201	80	--
07	02.00 pm	168	66	144
08	03.00 pm	139	45	--
09	04.00pm	83	39	69
10	05.00 pm	55	22	--
11	06.00 pm	20	20	--

All values are in $\mu\text{g}/\text{m}^3$ USEPA Hourly Standard—235 $\mu\text{g}/\text{m}^3$

Table-VI

Ambient air monitoring of Ozone at MSW site at Bhopal
(M.P.), Date : 21.12.2006

S.No.	Time	Rasla Khedi	Khejda village	Bhanpura village
01	08.00 am	29	20	--
02	09.00 am	45	20	53
03	10.00 am	105	40	--
04	11.00 am	171	52	--
05	12.00 noon	241	74	139
06	01.00 pm	218	82	--
07	02.00 pm	190	68	153
08	03.00 pm	155	57	--
09	04.00pm	90	45	80
10	05.00 pm	80	26	--
11	06.00 pm	20	20	--

All values are in $\mu\text{g}/\text{m}^3$ USEPA Hourly Standard—235 $\mu\text{g}/\text{m}^3$

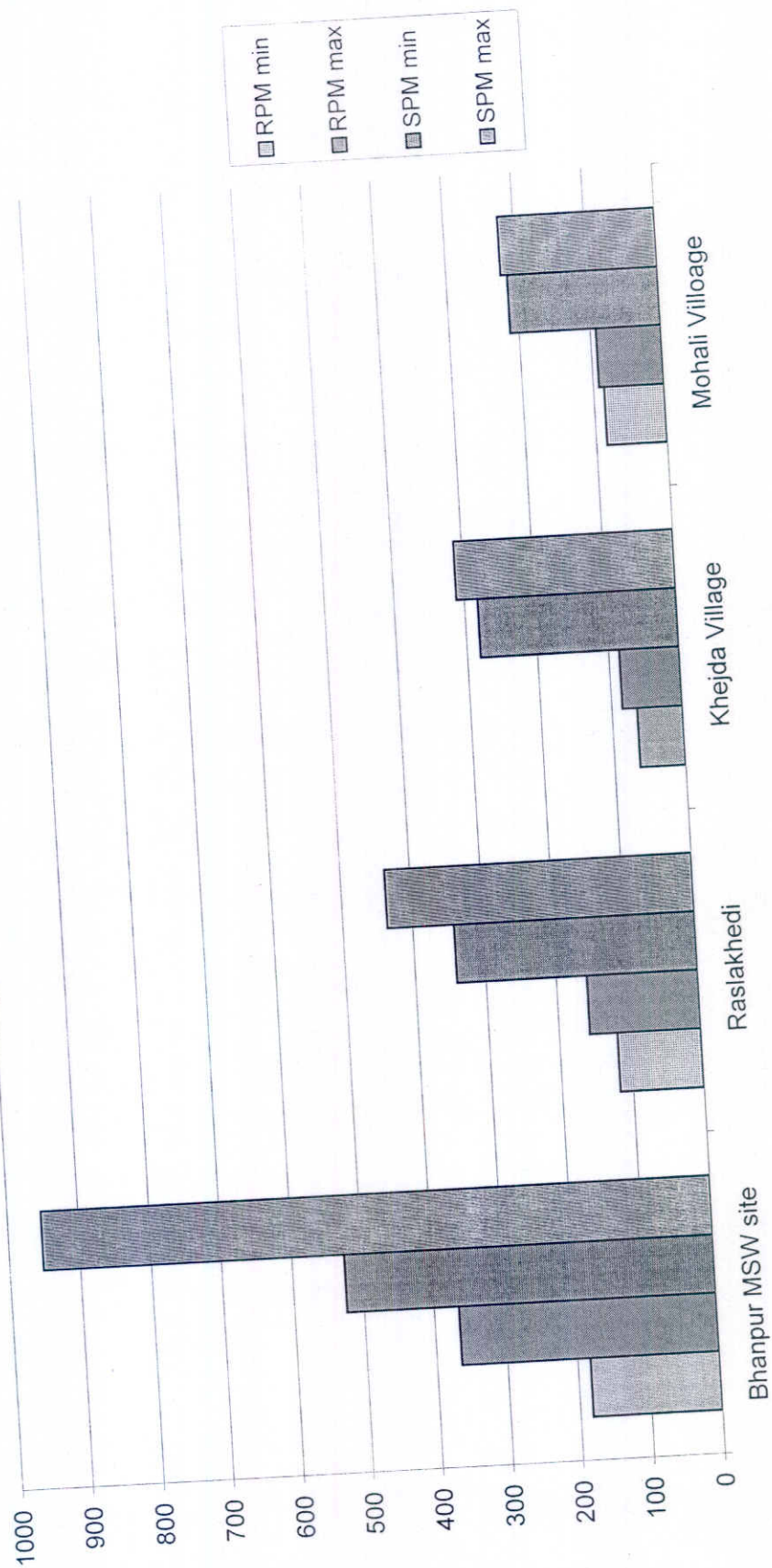
Table-VII. Physico-chemical parameters of ground water in and around MSW site Bhopal, M.P.

S.No.	Location	Colour	pH	Cond.	TS	K	COD	TH	Cl	NO ₃	SO ₄	PO ₄	F	FC/100ml
1	Anganwadi no. 436	Clear	7.33	1672	1432	7.3	8	776	290	2.46	31	0.52	0.49	32
2	Shikha beauty Parlour	Clear	8.13	1175	912	5.2	6	504	174	3.48	22	0.32	0.52	16
3	Mohan Singh well, Khejda	Clear	7.15	1060	916	2.1	6	512	178	4.71	15	0.11	0.32	40
4	Govt. School, Mohali	Clear	7.76	1416	968	3.0	6	576	182	0.89	16	0.32	0.11	12
5	MSW site	Clear	7.31	2040	1770	4.5	10	420	304	2.47	48	1.26	0.95	160
6	BMC B/W near People's Hospital	Clear	7.62	1308	1052	1.7	8	692	226	0.65	509	0.80	0.38	03
7	Patra River	Blackish	7.91	850	922	21.9	240	482	170	7.90	--	--	--	-

S.No.	Location	Colour	pH	Cond.	TS	K	COD	TH	CL	NO ₃	SO ₄	PO ₄	F	FC/100ml
1	Anganwadi no. 436	Clear	7.32	1820	1542	6.6	8	690	310	1.32	26	0.80	0.46	20
2	Shikha beauty Parlour	Clear	7.68	1281	774	4.9	6	462	190	2.19	15	0.41	0.40	24
3	Mohan Singh well, Khejda	Clear	7.55	1268	864	1.5	6	448	170	3.11	11	0.35	0.60	12
4	Govt. School, Mohali	Clear	7.41	1240	802	4.1	6	462	184	0.92	16	0.30	0.32	09
5	MSW site	Clear	8.01	1621	1140	3.3	6	640	240	1.92	31	0.48	0.68	80
6	BMC B/W near People's Hospital	Clear	7.29	1140	910	1.2	4	370	160	0.52	07	0.21	0.44	07

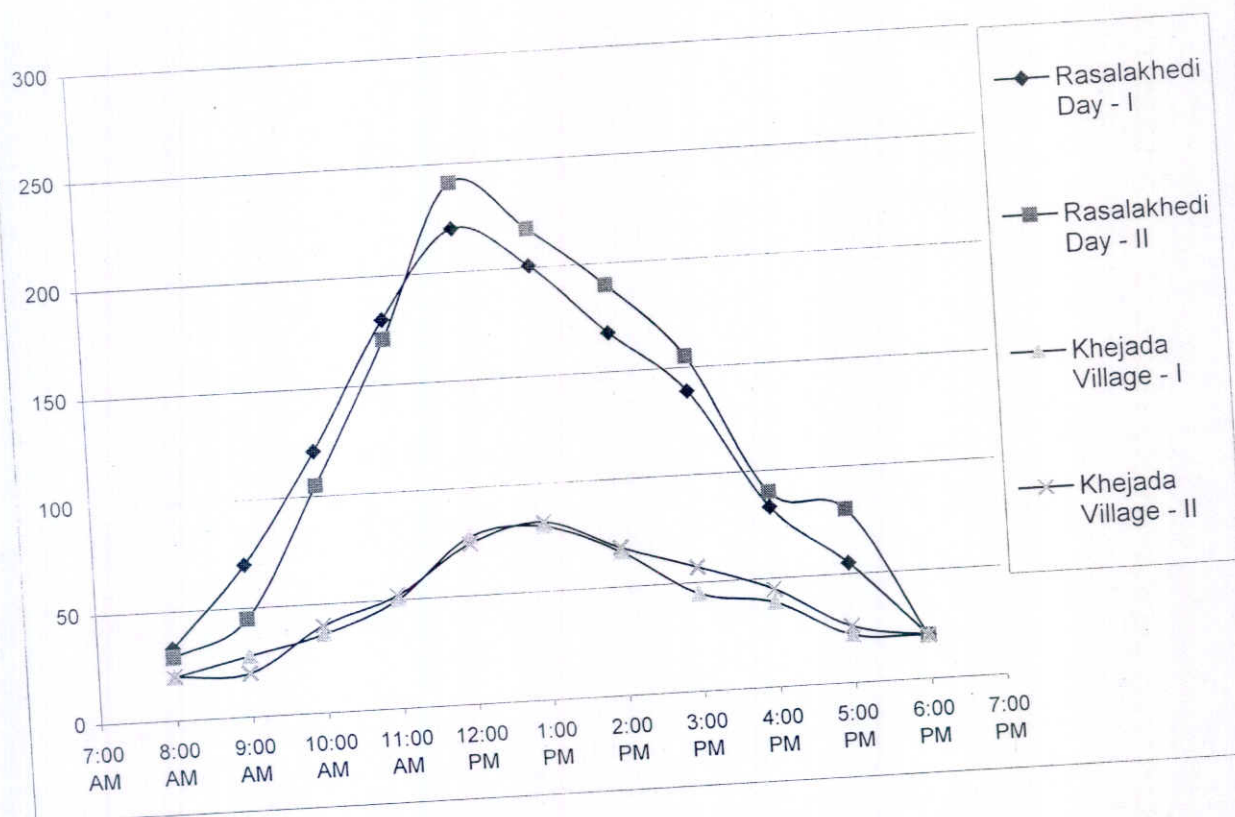
All values are in mg/l. except pH, colour and conductivity ($\mu S/cm$). Analysis report is based on grab sampling.

Fig.3 Min-Max Concentration of SPM/RSPM at MSW,Bhopal(2006-07)



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Fig. 4 Ozone pattern at MSW Dumpsite, Bhopal(2006-07)



- j. In rainy season the runoff of MSW dumpsite flows towards Patra River, which subsequently joins Halali Dam (used for irrigation and fish farming).
- k. The Madhya Pradesh State Agro Industries Development Corporation Ltd. is running an organic manure plant based on solid waste at MSW Dumpsite, Bhopal with the total capacity to process 100 MT of solid waste per day. This plant is running successfully and the manure produced is sold to the farmers of MP with the help of its district offices as well as with the help of private dealers. The present retail price of the manure sold to the end-users is Rs.2100/- per MT, while the ex-factory price to the dealers is Rs.1250/- per MT.

Major sources of generation of Municipal Solid Waste

Domestic Waste	House hold waste - Kitchen, house cleaning, old papers, packing, bottles, crockery, garden trimmings etc.
Commercial Waste	Waste generated at business premises, shops, departmental stores, spoiled discarded goods etc.
Street sweeping	Unconcerned throwing, littering, stray animal, roadside tree leaves, rubbish from drains.
Debris and construction waste	Frequent digging of roads by various utilities comprising earth, brickbats, stones, wooden logs etc.
Waste - Offal, dead animals etc.	Offal waste generated from slaughter house etc.

Current waste management systems of Bhopal Municipal Corporation (BMC) & Indore Municipal Corporation (IMC) are not as per norms. BMC & IMC adhere to the traditional approaches of collection and disposal of MSW. Due to non-segregation of waste, toxic materials (chemicals) even animal bodies/wastes also landed in the municipal waste stream ending up at the landfills, which serve as dump yards.

Studies were taken up to assess the contamination status in and around the MSW dump sites at Bhopal & Indore. The ambient air quality (for NO_2 , SO_2 , RSPM, SPM, O_3 , Ammonia) and ground water (for physico-chemical parameters, heavy metals, TOC, AO_x and POPs) were monitored during 2006-07.

manganese ranges from BDL to 0.28 mg/L, zinc ranges between 0.78 to 1.50 and copper fluctuating from BDL to 0.01 mg/L during this study.

AO_x represents a group of halogenated organic compounds and is a quantity to estimate the total content of activated carbon - absorbable halogenated organic matter in water sample. Significant concentrations of AO_x (22 to 34 µg/L) were observed in ground water samples collected from MSW dumpsite. The presence of AO_x indicates man made origin of the pollutants. Total Organic Carbon (TOC), which contributes in the formation of AO_x, was observed in the range of 15 to 25 µg/L.

The ground water samples from MSW dumpsite, Bhopal were also tested for POP (Persistent Organic Pollutants) i.e. DDT, Chlordane, Hexa Chloro Benzene (HCB), Endrin, Aldrin, Dieldrin and Heptachlor, but none of them was found in the water samples.

2.10 General observations:

- a. There is no system of door-to-door collection of waste and adequate community bin facilities are also not provided to collect the waste. In the absence of doorstep collection and inadequate community bins, people throw the waste on the street, which is collected through street sweeping. Street sweeping is the only method of primary collection of waste.
- b. There are 78 hotels and 110 registered restaurants in Bhopal city. No arrangements of primary collection of waste from hotel and restaurants are made. Hotels and restaurants, therefore dispose off their waste on the street or into the municipal bins.
- c. There are 7 main vegetable and fruit market namely Navbahar subzi mandi, Jahangirabad market, New market, Kotra market, Bittan market, Kasturba haat, New market haat and other small and local market, where about 50-60 tonnes of garbage generated per week. Adequate storage facility is not created in

colorimetric technique. Modified Jacob and Hochheiser method for NO_2 -ambient air is absorbed in a solution of sodium hydroxide and sodium arsenite and analyzed by colorimetric technique.

Monitoring of ammonia and ozone was also done at selected locations. Ammonia was measured by Indophenol method by absorbing the air sample in 0.1N H_2SO_4 . For determination of ozone, air sample was passed through 1% solution of potassium iodide buffered at 6.8 pH and concentration was measured by photometric method.

Ground water samples were collected for the various parameters like pH, chloride, nitrate, fluoride, sulphate, phosphate and heavy metals and were analysed as per CPCB methods. Besides, some specific pollutants like AO_x and POPs were also analyzed at selected locations.

2.9 Results and discussion

2.9.1 Ambient air quality

Summarized data of average concentrations of six air pollutants, such as suspended particulate matter, respirable particulate matter, sulphur di oxide, nitrogen dioxide, ammonia and ozone for the study period are depicted in Table I to VI and Figure 2 to 4.

The estimated SPM concentrations in the ambient air of the four sampling sites varied between $213 \mu\text{g}/\text{m}^3$ to $952 \mu\text{g}/\text{m}^3$, exceeding the CPCB standards for rural and residential areas. Respirable particulate matter (RSPM) was found in the range of $92 \mu\text{g}/\text{m}^3$ to $365 \mu\text{g}/\text{m}^3$, beyond the prescribed limits. The primary sources of dust are wind blown soil/MSW materials and burning of MSW at dumpsite.

SO_2 values varied between 2 to $13 \mu\text{g}/\text{m}^3$ and the NO_2 concentrations were in the range of 14 to $71 \mu\text{g}/\text{m}^3$. These concentrations were well within the limits prescribed in MSW Rules 2000. Ozone values varied between 20 to $241 \mu\text{g}/\text{m}^3$ and Ammonia (as NH_3) in the ambient air of the four sampling stations varied from BDL to $119 \mu\text{g}/\text{m}^3$.

2.6 Communal storage of MSW

The city has 990 official communal storage MSW sites as under:

1) Kachara Ghar (Dust Bins)	:	50
2) Metal Containers	:	350
3) RCC Rings	:	300
4) Open sites	:	210
5) Metal Containers(Auto lifting):		80
Total:		990

The above shows sites (1) to (4) are not suitable for temporary storage of MSW. The RCC bins overflows and open sites pose a problem of health and sanitation. The Metal Containers (Auto lifting) are well utilized with auto lifting system (Pic.12).

The major landfill site of the Bhopal city is near Bhanpura on Vidisha road, 5 Km from main Nadra bus stand of Bhopal. The total area of the site is about 58 acres and at present 36-acre land used for dumping purpose. During last 30 years Bhanpura is being used as a trenching ground and about 350-400 MT waste dumped every day. Addition to this, many more non-designated dumpsites present at different locations of the city. Nature of waste and land use pattern of the area are given below:

S.No.	Location in city	Land use	Type of waste
1	Subhash nagar Railway Crossing	Mixed type	House hold and commercial
2	Under bridge Arera colony	Residential	House hold
3	Near Aradhana Nagar	Residential	House hold
4	Categorized market	Commercial	Commercial
5	Bairagarh	Mixed type	House hold and commercial

2.7 Sampling locations

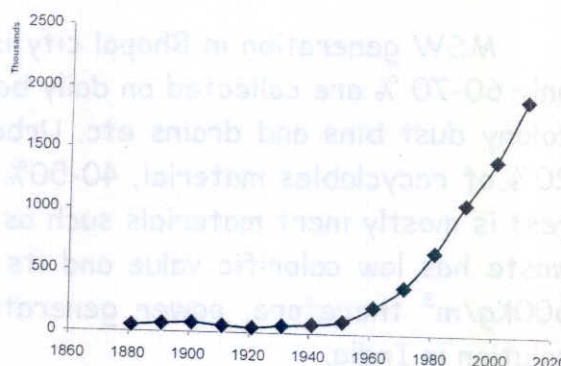
In order to assess the contamination status with respect to the emission sources of particulate matter and gases around the dumpsite, four sampling stations were established as AAQM-1 to AAQM-4. Total sixteen samples from four locations were collected using Respirable Dust Sampler

Composting:	20% (100 ton/day) by Govt. undertaking company
	- Adjacent to the landfill site;
	- Compost is sold commercially
Landfill:	75 acres, open dumping
Expenditure:	25% of municipal budget. Current cost recovery include conservancy tax as a part of property tax/sanitary tax.

2.2 Municipal Demography

Till 1950, Bhopal experienced a gradual increase in population. But with the establishment of BHEL Plant and declaration of Bhopal as a capital city its population swelled from 1.0 Lac in 1951 to 2.22 Lacs in 1961 (118% Growth Rate). During the two decades of 1961-81 the population of Bhopal tripled (6.71 Lacs) and in 1991 it touched the million mark (Fig.1). According to 2001 census the population of Bhopal city is 14,33,875 (39% decadal growth rate).

Fig.1. Population Growth of Bhopal City



2.3 History

"Majlis-e-intezamia" was the name of first municipal body, which came into force in 1907 in the erstwhile Bhopal estate. First city survey was conducted in 1916 after the enforcement of Municipal act. Up to 1956 area under Bhopal Municipal limit was very small, but after that some more surrounding villages were added to it. The total area under Bhopal municipal limit reached to 71.23 Sq. Kms by 1975. At present total area under Bhopal Municipal Corporation is 285 Sq. Kms. Initial Bhopal Municipality was a 20-member committee, headed by a non -Governmental president.

The Municipal Board was constituted for the first time in 1952 with Shri. Abdul karim Babu Miya as president and Shri. Deendayal as vice-president. Later on, the status of Municipal Board was upgraded to municipal council & an IAS officer was appointed as Chief Administrator. In 1983, Bhopal Municipal Council got the status of Municipal Corporation, with total

PART-II

Status of MSW dumpsites at Indore

3.0 Introduction:

Indore derives its name from the 18th century Indershwari temples. The city is situated along 75°25' E longitude and 22°20' N latitude on the bank of the rivers Saraswati and Khan and is the largest city in M.P. Indore was planned and built by Rani Ahilyabai Holkar. There are numerous monuments associated with the Holkar's in the city. 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 dense populated area. State highways and other roads connect the city with the state capital Bhopal, all district headquarters of the divisional and important towns within the district. It is naturally endowed with a beautiful landscape and salubrious climates. Indore is a big industrial centre and has the look of a mega city.

Solid Waste Management is one of the most essential services for maintaining the quality of life in the urban areas and for ensuring better standards of health and sanitation. In India, these services fall short of the desired level as the systems adopted are out dated and inefficient, Institutional weakness, shortage of human and financial resources, improper choice of technology, inadequate coverage and lack of short and long term planning are responsible for the inadequacy of service. The City of Indore is also having these deficiencies in varying degrees and there is a need to make substantial improvement in the MSW management practices prevailing in the city to raise the standards of health, sanitation and urban environment keeping pace with the rapid urbanization and growing population.

The city of Indore has a population of 16 lac and an area around 285.88 sq kms. The population data collected from the year 1971 to 2001 census is presented in Table-VIII. This table also shows the growth rate of population around 40 percent for period 1971-81 and 1991-2001. In next 20-25 years, there would be cent percent urbanization, which puts tremendous pressure on the adjoining productive agricultural land and on other natural resources such as surface water bodies and groundwater sources.

Table-VIII: Year wise population & % growth in Indore

Year	Population	Growth rate %
1971	537000	
1981	829327	44.68
1991	1109000	31.63
2001	1626297	41.31
2011(Projected)	2104658	
2021(Projected)	2681831	

Presently, Indore city is divided into 69 Wards and 11 Zones. Elected body has a term of 5 years. The corporation performs its function as per the provision of an Act governing the Municipal Corporations in the State. The administration of the corporation is under the Mayor. The Municipal Commissioner is the CEO, and is a senior State Administrative Service Officer. The Municipal Commissioner is assisted by a work force of municipal officers.

3.1 The present status of MSW management practices in the Indore city.

Most of the population in Indore city disposes the waste into the municipal bins, streets, open spaces, drains, etc. Segregation of recyclable waste is not practiced. Most of the recyclable material is disposed off along with domestic and trade waste. Therefore recyclable waste is generally found mixed with garbage on the streets, into the municipal bins and at the dumpsites from where part of this waste is picked up by the rag pickers. There is no system of door-to-door collection of waste except in few local areas.

M/s Eco -Pro Environmental Services, Indore prepared municipal Solid Waste Management Plan for Indore Municipal Corporation in 2005 for obtaining financial help from the government. As per the report, there are 150 Hospitals and Nursing homes in the city having 6,000 beds. A private operator is transporting the waste to common biomedical waste treatment facility where disposal of waste is done as per guidelines. Some pathology labs, small nursing homes, dental clinics, clinics and dispensaries still throw their waste along with municipal solid waste. There are 90 hotels and 310 restaurants in the city. Primary collection of food waste from hotel and restaurants is not yet made. These establishments, dispose off their waste

on the streets or into the municipal bins. There are five main vegetable and fruit markets, where 30 to 35 tonnes of garbage is generated each day. Adequate storage facility is not created in the market area, which results scattering of market waste in open space causing unhygienic conditions in that area.

There has been a significant increase in the generation of municipal solid waste in Indore over the last few decades. This is largely a result of rapid population growth in the city. The daily estimated generation of municipal solid waste in Indore city is about 800 to 850MTD, which is collected through street sweepings and from communal waste storage sites. The quantity of waste generally transported each day is 760 MT, which is about 85% of the waste generated in the city. The details on communal storage of waste, provided by Municipal Corporation, Indore and physical characteristics of waste are shown in Tables IX and X respectively.

Table-IX: Quantity of Communal storage of waste & vehicle use for transportation of waste provided by Municipal Corporation, Indore

Storage material	Quantity (Nos)	Vehicles	Quantity(Nos)
Dustbin	200	Tata Dumper mini 609	10
Metal containers	400	Tata Dumper open 709	13
R.C.C rings	300	Cargo Leyland 907(closed Wagon)	17
Open sites	200	Eicher open Dumper	12
Containers	100	Eicher compact waste wagon	1
		Leyland open Dumper(Big)	3
		Ashoka Leyland cargo 909+Dumper placer	14
		Containers (skip)	150
		J.C.B (Loader)	1

Table-X: Physical Characteristics of Municipal solid waste generation by Indore city

S.No.	Characteristics		Percentage
1.	Recyclables	Paper	6.10
		Plastics	5.77
		Metals	0.55
		Glass	0.15
2.	Total Compostble		48.97
3.	Inert Matter		31.02
4.	Other Matter	Rubber & leather	2.95
		Rags	2.41
		Wooden Matter	2.08
Total			100.00

3.2 Description of MSW dumpsite

The main landfill site of the city is near Devguriadia on Nemawar road, around 15 Km from railway station. This dumpsite is located in the outskirts of the city towards eastern side. Sajjan Nagar is situated at North side of MSW site. Southwest part of the site covered by hilly rocks, whereas A-B road passing through the west side. In the southern part of it a private warehouse, one engineering collage and one masala factory is located.

The total area of the site is about 146.32 acres used for dumping purpose. Disposal of MSW at Devguriadia site in Indore was initiated in the year 1969. And since then it is being used as a trenching ground and about 720 MT waste dumped here per day, collected from various wards of the city. No scientific method of waste disposal is adopted. All the waste is disposed off at the landfill site by crude dumping.

The biodegradable fraction is quite high in MSW, essentially due to vegetables, households garbage, sanitary waste, slaughter house wastes etc. The ash and fine content of Indore MSW is also high due to the practice of inclusion of the street sweepings, drain silt, and construction and demolition debris in MSW.

3.3 Sampling locations

In order to assess the effect of the open and unscientific dumping of the MSW at Trenching ground, Devguriadia ambient air sampling at three different locations with respect to trenching ground has been carried out. The main reasons of the air pollution was burning of MSW, therefore SPM, SO₂, NO₂, O₃, and NH₃ were monitored during the study. Details of the monitoring station are given below:

- | | | |
|-----|--------|---|
| (1) | AAQM-1 | Located at the north-east entrance of the MSW Dumpsite. |
| (2) | AAQM-2 | Located at M/s Rishabh foods industry on north side of MSW site, around 200 meters away from dump site. |
| (3) | AAQM-3 | located at M/s Lakhani Industry about 1 Km from west side of MSW site,. |

Devguriadia disposal site is the only disposal site of the Indore city. Over the year the rainwater percolated from the dumping grounds might has reached the ground water carrying some of the contaminants from the municipal solid waste. Therefore, this study was undertaken to determine the effect and extent of contamination. Five locations were selected for samples collection of various representative parameters. Details of the monitoring station are given below:

- (1) Near Dev garden
- (2) Inside M/s Rishabh foods Industry
- (3) Inside IESM campus
- (4) Inside M/s Lakhani footwear Industry
- (5) Run off from MSW site

3.4 Material & Methods

Adopted same as discussed in Part-I (MSW, Bhopal) of this report.

3.5 Results and Discussion

The quality of ambient air is summarized in Tables XI-X and Figures 5-7. Monitored data provides a comprehensive picture of the ambient air & ground water quality around dumpsite area. The pH value of the ground water was ranged from 7.15 to 7.8. Water samples had wide range of conductivity, from 540 μS to 2690 $\mu\text{S}/\text{cm}$. The highest conductivity was observe in premises of M/s Lakhani industry and lowest conductivity was observed in the premises of Institute of Engineering, Science and Management (IESM) campus situated near dumpsite. At 3 locations, Total hardness exceeded the standard norms i.e. 300 mg/L. Chlorides, nitrate and sulphate of all the ground water samples were found well within the limit. Ground water from M/s Lakhani industry contains slightly high fluoride value of 1.02 mg/L, which exceeds marginally the permissible limit of drinking water standard of 1.0 mg/L. Bacterial contamination was also found in all the ground water samples.

MSW leachate containing heavy metals finds its way into the underground water, rendering it unfit for drinking. In view of this the Heavy Metals like Nickel (Ni), Iron (Fe), Manganese (Mn), Copper (Cu) Chromium (Cr), Cadmium (Cd), Lead (Pb), Zin (Zn) and Cobalt (Co) were analyzed in all the ground water samples. Except Fe, Mn, Zn and Cu, the other metals were not detected during the study period. Iron ranged between 0.04 to 0.8 mg/L, manganese from BDL to 0.08 mg/L, zinc ranges from 0.05 to 0.36 mg/L and copper fluctuated from BDL to 0.04 mg/L during this study.

AO_x represents a group of halogenated organic compounds and is a quantity to estimate the total content of activated carbon - absorbable halogenated organic matter in water sample. Significant concentrations of AO_x (25 to 40 $\mu\text{g}/\text{L}$) were observed in ground water samples collected from MSW dumpsite. The presence of AO_x indicates man made origin of the pollutants. Total Organic Carbon (TOC), which contributes in the formation of AO_x , was observed in the range of 25 to 50 $\mu\text{g}/\text{L}$.

The ground water samples from MSW dumpsite, Indore also tested for POP (Persistent Organic Pollutants) i.e. DDT, Chlordane, Hexa Chloro Benzene (HCB), Endrin, Aldrin, Dieldrin and Heptachlor, but none of them is found in the water samples.

Total three sampling locations were selected at MSW site, M/s Rishabh Foods Industry, M/s Lakhani Industry and MSW site gate to evaluate the ambient air quality scenario in and around the dumpsite. Total six samples were collected from each location and analyzed for the pollutants like SPM, SO₂, NO_x, NH₃ and O₃. Concentrations of SPM found highest at the AAQ station located at MSW dumpsite. The primary sources of dust are wind blown soil/MSW materials and burning of MSW at dumpsite. Heavy traffic on State Highway (Nemawar road) located near the dumpsite also responsible for increase of SPM level and other gaseous pollutants. Concentrations of SO₂ & NH₃ were found well within the limits as prescribed in MSW rules, 2000. Concentrations of NH₃ ranged from 14 to 112 µg/m³. The maximum value for ammonia was observed at M/s Rishabh Foods Industry area mainly due to burning and decomposition of garbage. The ozone concentrations were in the range of BDL to 344 µg/m³. The maximum concentration of ozone was found near M/s Rishabh Foods Industry area, which exceeds the prescribed norms of USEPA (Hourly standard i.e. 235 µg/m³).

3.6 General observation

- a. Segregation of different category of waste is not in practice. Most of the waste materials are disposed off together.
- b. There are five main vegetable and fruit markets, where 30-35 tonnes of garbage is generated per day. Due to shortage of adequate storage facility, market waste is thrown in open space causing unhygienic conditions.
- c. Huge quantity of smoke was observed at MSW site due to burning of municipal solid waste.
- d. Dump site has no boundary wall & gate; it was observed that animals and rag pickers freely moved within the dumpsite.
- e. Dead animals dumped within the dumpsite premises. Leather removals from dead animals are very unhygienic.
- f. A weighbridge was not installed for monitoring the quantities of wastes carried by waste transport vehicles to the site. Approach roads leading to the site were not maintained properly.

- j. No concept of housekeeping within the MSW dumpsite. No tree plantation around the dumpsite was observed.
- l. No provision was observed for the leachate collection during rainy seasons. Piezometric well was not found for the check of leachate.

The sites are basically trenching ground and not sanitary landfill sites. Hence, the systematic disposal of waste is not possible and only unorganized dumping is being done at all the site.

Table-IX Ambient air monitoring at MSW site at Indore (M.P.)

Date : 17.11.2006

S. No	Time	MSW Site				M/s Rishabh food				M/s Lakhani Industry			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am - 02.00pm	BDL	41	35	434	12	70	70	386	BDL	41	49	414
02	02.00 am - 06.00 pm	8	65	21		10	83	105		8	55	42	

Date : 18.11.2006

S. No	Time	MSW Site				M/s Rishabh food				M/s Lakhani Industry			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am - 02.00pm	9	82	14	522	10	56	84	347	6	33	42	450
02	02.00 am - 06.00 pm	8	61	28		8	69	98		7	50	42	

Date : 14.12.2006

S. No	Time	MSW Site				M/s Rishabh food				M/s Lakhani Industry			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am - 02.00pm	8	65	42	511	11	67	77	262	6	42	49	225
02	02.00 am - 06.00 pm	8	72	35		13	82	98		8	59	35	

Date : 15.12.2006

S. No	Time	MSW Site				M/s Rishabh food				M/s Lakhani Industry			
		SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM	SO ₂	NO ₂	NH ₃	SPM
01	10.00 am - 02.00pm	9	61	21	457	9	71	112	178	BDL	49	28	205
02	02.00 am - 06.00 pm	11	74	42		12	85	91		8	61	56	

All values are given in $\mu\text{g}/\text{m}^3$

Table X: Ozone pattern at MSW Dumpsite, Indore M.P.(2006-07)

Date : 14.12 .2006

S.No.	Time	MSW site	M/s Rishabh Industry	M/s Lakhani Industry
01	08.00 am	31	32	29
02	09.00 am	40	104	35
03	10.00 am	55	164	67
04	11.00 am	3	240	75
05	12.00 noon	72	268	68
06	01.00 pm	80	340	112
07	02.00 pm	75	344	60
08	03.00 pm	60	256	51
09	04.00pm	33	180	26
10	05.00 pm	24	120	17
11	06.00 pm	20	68	20
USEPA Hourly Standard—235 $\mu\text{g}/\text{m}^3$				

Date : 15.12 .2006

S.No.	Time	MSW site	M/s Rishabh Industry	M/s Lakhani Industry
01	08.00 am	28	54	38
02	09.00 am	35	88	26
03	10.00 am	49	120	42
04	11.00 am	57	187	54
05	12.00 noon	69	207	69
06	01.00 pm	89	281	84
07	02.00 pm	71	315	88
08	03.00 pm	63	289	88
09	04.00pm	44	229	78
10	05.00 pm	29	173	37
11	06.00 pm	20	62	23
USEPA Hourly Standard—235 $\mu\text{g}/\text{m}^3$				

All values are given in $\mu\text{g}/\text{m}^3$

Fig 5 Concentration of Ozone in and around MSW site, Indore :Date 14.12.06

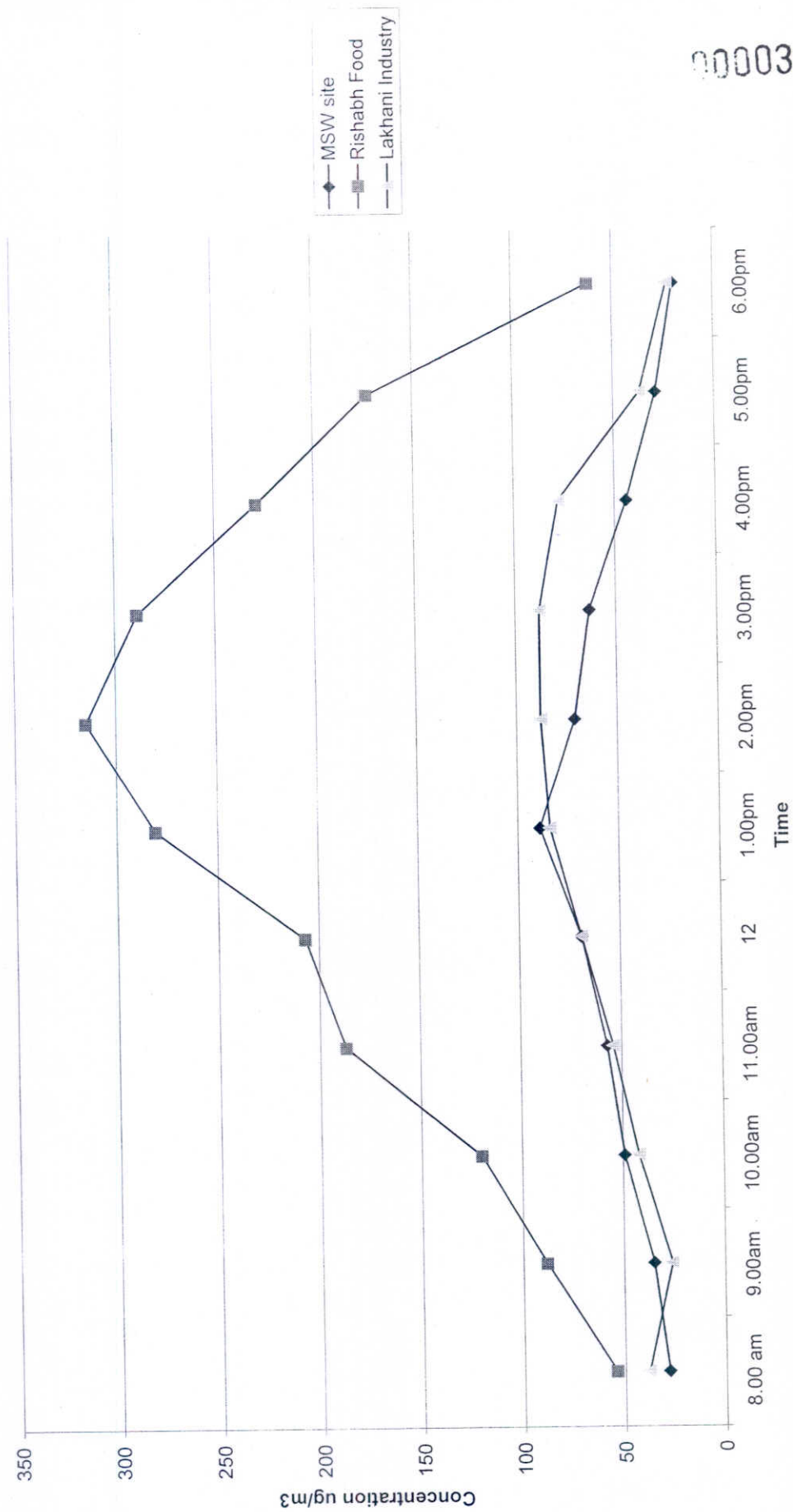


Fig. 6 Concentration of Ozone in and around MSW dump site, Indore on dated 15.12.2006

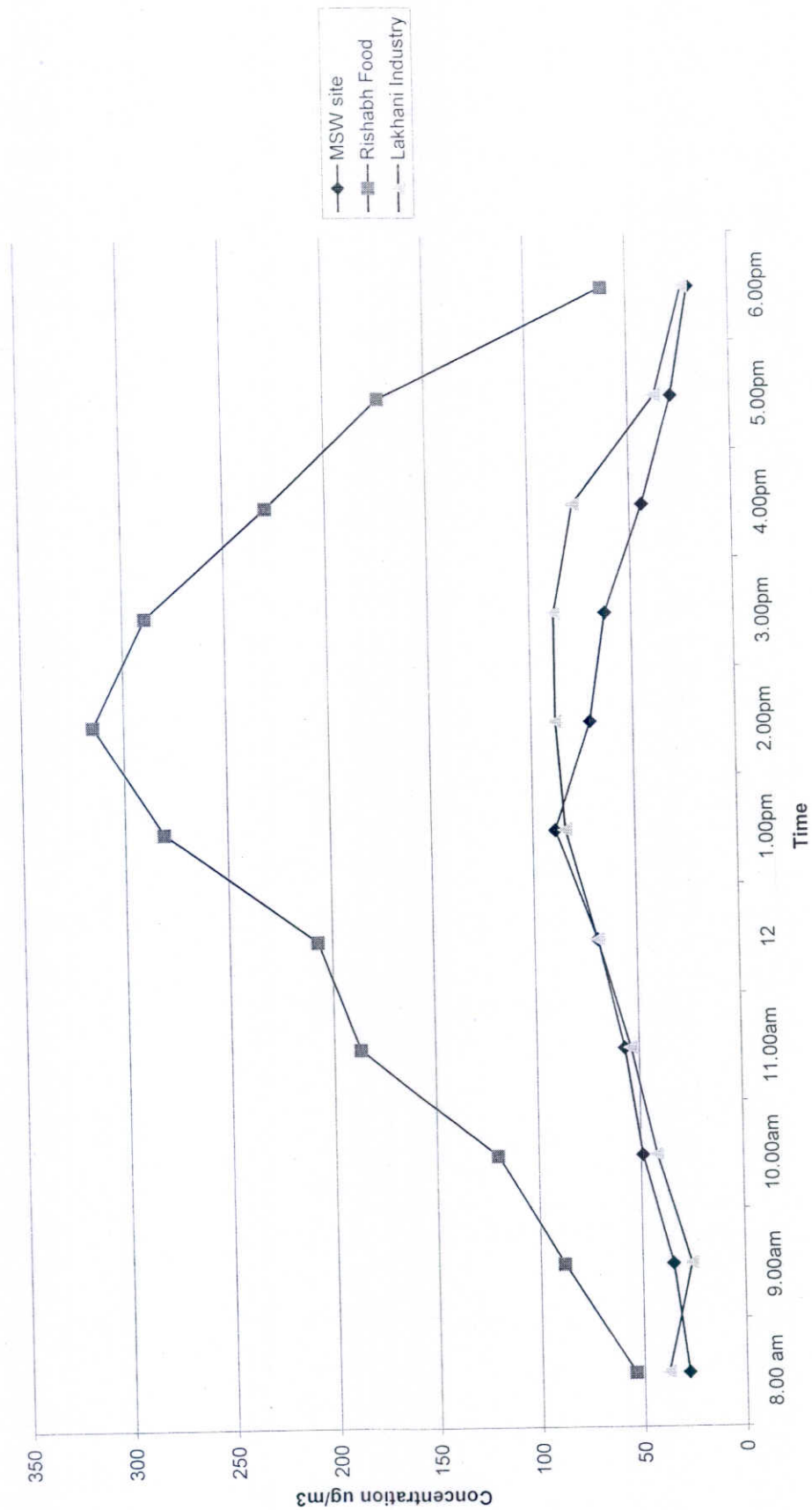
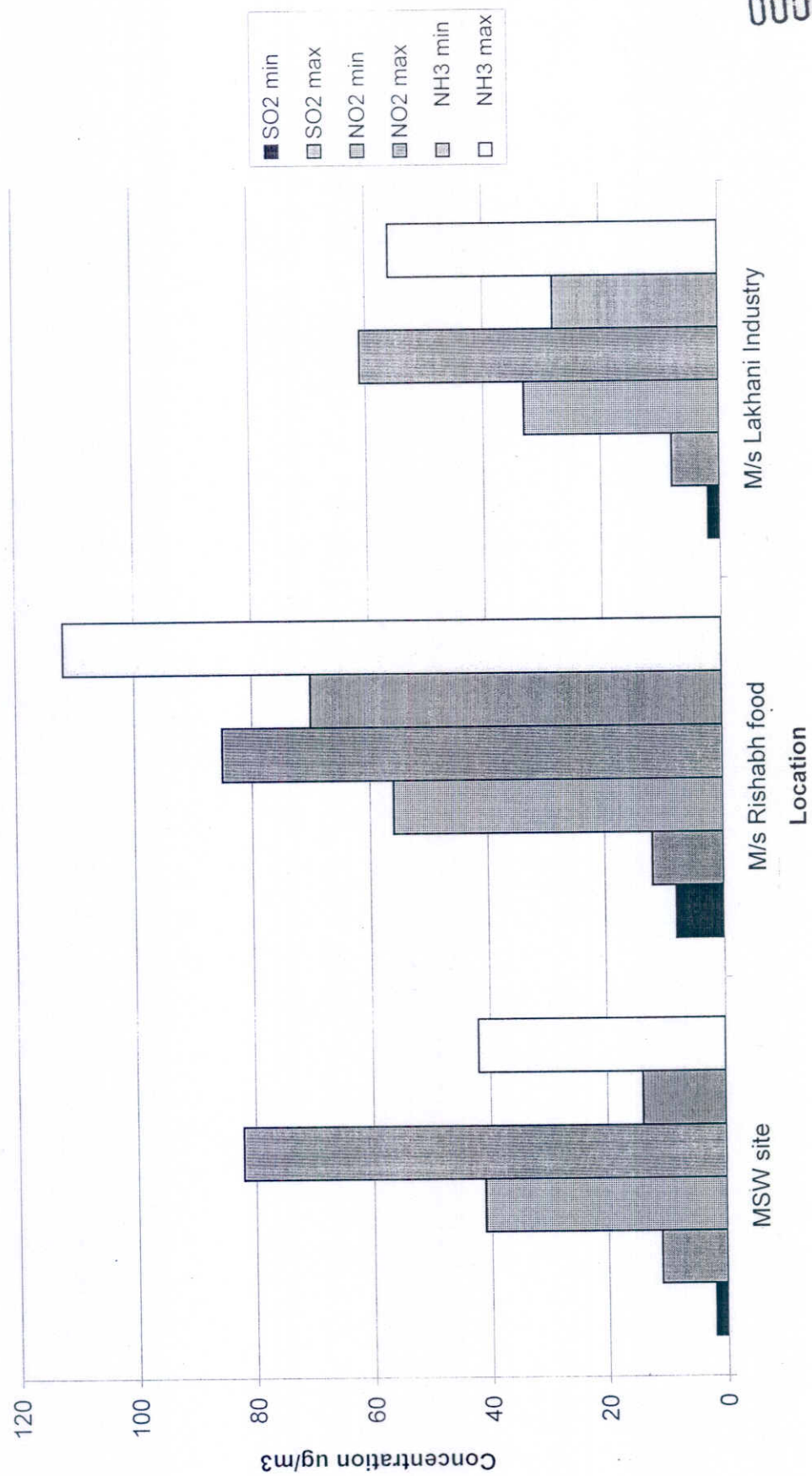


Fig 7 Min-Max Concentrations of SO₂, NO₂ & NH₃ at MSW site Indore(2006-07)



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4.0 Health impacts

Due to the absence of working norms for handling municipal wastes, the municipal workers are most affected by the occupational health hazards of waste handling. As TERI reports describe, in addition to municipal workers, the ragpickers who operate informally for long hours rummaging through waste also suffer from various occupational health diseases-respiratory illnesses from ingesting particulates and bio-aerosols, infections from direct contact with contaminated material, puncture wounds leading to tetanus, hepatitis and HIV infection, headaches and nausea etc. The average quarterly incidence of diarrhea was 85%, of fever was 72% and of cough and cold was 63% amongst the 180 ragpickers studies in 1995 at open dumps of city of Calcutta (DISH, 1996). In addition to occupational health, environmental health and injury issues also need to be mentioned in the context of waste management. Contaminated leachate and surface run-off from land disposal facilities affect ground and surface water quality. Open burning of MSW creates the air pollution (volatile organic compounds and dioxins), which may increase cancer incidence and psychological stress for those living near the dumpsites. Drains clogging due to uncollected wastes leading to stagnant waters and hence mosquito vector breeding are few of the environmental health issues, which affect the waste workers as well as general public.

An important and challenging problem governing the urban environmental scenario is related to MSW. An indicator on the amount of waste generated is a first approximation of environmental pressure on air, water, and land resources. Poor collection or disposal practices attract and promote the breeding of insects, rodents and pathogens that can cause and transmit diseases. Furthermore, open burning of MSW adversely affects the environment by emitting pollutants in the atmosphere. Thus it is increasingly felt that the first step towards sustainable waste management programme is to quantify factors affecting environmental quality pertaining to MSW.

5.0 Recommendations

On analyzing the waste management scenario of Bhopal and Indore, few suggestions/recommendations are made.

1. In private colonies (duplex bungalows), societies, complexes and multi storied buildings, normally no sweeper are provided by corporation, hence private sweepers generally engaged. It may be therefore made compulsory for the management of these societies & complexes to keep community bins or containers in which dry and the members may separately store wet waste. BMC/IMC should arrange to collect waste from these community bins/containers through handcart, tricycle, pick-up vans or other waste collection vehicles as may require, on daily basis.
2. The BMC/IMC should collect waste from old city area (narrow streets) and slums by bell ringing/whistle system along their main access lanes. Residents should bring their wastes from their houses to hand carts.
3. Commercial establishments, shops, hotels and restaurants normally open after 9 or 10 am in these cities. These timings do not synchronize with the usual work schedule of sweepers. Under this situation, sweepers may first carry out the work of street sweeping in the morning hours as usual and soon thereafter take up the work of doorstep collection of waste, after most of the shops have opened.
4. Vegetable, fruits, meat and fish markets wastes should be removed on a daily basis by the BMC/IMC. A special pick up arrangement should be made for collection of waste from marriage halls, kalyan mandaps, community halls and exhibition halls daily on a full-cost-recovery basis.
5. Proper disposal of urban solid waste is necessary for preservation, improvement of environment and public health. Resource recovery is also possible, if identified the potential sources.
6. In these cities solid wastes are being dumped on roadsides, on railway track and in low lying areas, It is essential to undertake a detailed study of municipal solid waste collection, storage, transportation, segregation and disposal scenario from cradle to grave so that cities can be kept clean. This has also been

recommended in Municipal Solid Waste (Management and Handling) Rules, 2000.

7. Solid waste should be disposed off in appropriate place or landfill site developed as per MSW Rule 2000. Criteria for landfill site selection and its development should be carefully adopted.
8. The possibility of contamination of groundwater and surface water due to percolation and surface runoff from landfills should be periodically checked. The factors like toxicity of waste, volume of the contaminant in it, the geographical conditions underlying the site, the hydrologic conditions in the area and water bodies near dumping site should be properly investigated.
9. It was observed that dumping site in Bhopal city is near to river systems, which might results in the surface and ground water contamination. In Bhopal, Patra River flows at a distances of 500m from Bhanpura MSW dumpsite and is surrounded by agricultural fields.
10. In the present study period, ground pollution around the MSW sites was not significant. But, leachate study is necessary as heavy metals/ organics from municipal solid waste may percolate and contaminate the ground water. There are some mathematical models available, which can be applied for analyzing the movement of heavy metals/organics to ground water or surface water around the landfill area.
11. It has been observed that these dumping sites are receiving mixed nature of municipal solid wastes, but they do not have proper lining and leachate collection system. This is also recommended to develop present site as per Municipal Solid Waste (Management and Handling) Rules, 2000.
12. Any alternatives economically feasible techniques can be considered for the solid waste disposal taking all the precaution to avoid environmental damages viz. composting or energy recovery etc.

6.0 MSW Management Practices required in these cities are:-

6.1 Site selection for SLF

The main purpose of the siting process is to make the best use of the land resources available. The siting for disposal of solid waste and disposal facilities requires the synthesis of two distinct selection procedures, viz. a technical screening process based upon economic, engineering and environmental suitability, and public approval process.

In case of Bhopal, surroundings of Bhanpura dumpsite presently covered by dense population. Hence it is recommended that this site should be closed immediately and new site must be selected and developed as per MSW Rules, 2000.

In case of Indore, existing site may be upgraded as per MSW rules, 2000.

6.2 Responsibility of Individuals/Societies/Communities

Waste should not be thrown on the streets, footpaths, open spaces, drains or water bodies. Waste shall be stored at its source of generation separately in two bins/bags, one for food waste/bio-degradable waste and another for recyclable waste such as papers, plastics, glass, rags etc.

Waste such as used batteries, containers of chemicals, pesticides, discarded medicines and other toxic household waste, as and when produced, should be kept separately from the above waste and disposed off separately.

6.3 Municipal Corporations

Various steps must be taken by BMC and IMC to improve Solid Waste Management in these cities with the following objectives:

- Refine and strengthen SWM strategy by conducting need assessment through appropriate agencies in Micro-settings at the ward level.
- Ensure proper institutional arrangements viz. constitution of MSW cell within the Municipal Corporation, establishment of a regular surveillance system etc. for proper co-ordination and effective management of activities.
- Provide proper training/workshops and exposure to MSW staff/officials.
- Provide necessary equipment and supplies to the field staff engaged in MSW operations.
- Construct essential infrastructure for composting and safe disposal of waste with special attention to bio-medical and other hazardous waste.
- Evolve an appropriate legal framework through the State Government and other relevant provisions to address MSW issues.
- Establish a surveillance and monitoring system with due emphasis on social audit of the performance through active involvement of the community.
- Involve different stakeholders in O&M issues and activities should be undertaken with a view to achieve sustainability.

6.4 NGOs Participation

NGOs should be fully involved in public awareness and encouraging public participation in SWM planning and practice. The BMC and IMC may also encourage NGOs & co-operatives of rag pickers to participate in this issue and organize them for doorstep collection of waste and provide them an opportunity to improve their working conditions and income.

7.0 Conclusions:

If Municipal Solid Waste is left unattended it is likely to acquire a serious dimension. In recent years, some new functional responsibilities have been assigned to the Municipal Corporations & local bodies. In the present set up constitutionally the responsibility of providing basic services such as municipal solid waste disposal in the urban areas lies with the state government. Against this backdrop, this study tries to serve an input to policy planning of the states by identifying where the whole management of MSW needs to be improved along with commensurate changes in the urban infrastructure so that this issue may be incorporated in future schemes like; Jawaharlal Nehru Nagriya Vikas Yojna launched by Central Government. Lastly there is an urgent need of changing practices related to handling of MSW and refuse burning. It is generally observed that many households instead of putting their domestic garbage inside the community dustbins throw the waste all around the dustbin or just dumps it outside the house. Many households have the mindset of cleaning the areas inside the house but do not attach any importance on a more hygienic and scientific disposal technique. Some of the issues require more attention viz ;

- MSW Rules, 2000 are not fully known and well understood, especially to staff at operational level.
- Allowing all types of wastes to get mixed up, subsequently making it difficult to process economically and scientifically.
- General reluctance in enforcing segregation of waste at source by generators. Lack of legal framework through which segregation can be mandated and enforced.
- There is a lack of incentives for the agencies involved in collection, segregation and transportation towards waste reduction.
- Lack of awareness of waste processing technologies and development of scientific landfill sites. Undue focus on centralized facilities for processing, many vendor driven.

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ANNEXURE-I

MSW status at Bhopal & Indore city with cross-references to Municipal Solid Waste (Management and Handling) Rules, 2000

Schedule-1

S. No.	Compliance Criteria	Status	
		Bhopal	Indore
1.	Setting up of waste processing and disposal facilities- latest by Dec.2003	Not Complied	Not Complied
2.	Monitoring the performance of waste processing and disposal facilities- Once in six month	Not Complied	Not Complied
3.	Improvement of existing landfill site as per provisions of these rules- latest by Dec.2001	Not Complied	Not Complied
4.	Identification of landfill site for future use and making site(s) ready for operation- latest by Dec.2002	Not Complied	Not Complied

Schedule-II

S. No.	Parameters	Compliance criteria	Bhopal	Indore
1.	Collection of Municipal Solid Waste	(i)Organizing house-to-house collection of municipal solid waste through any of the methods like community bin collection, house-to-house collection.	Some selected areas covered by Societies/NGOs	Some selected areas covered by Societies/NGOs
		(ii) Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas.	NC	NC

		(iii) Wastes from slaughterhouses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature shall be managed to make use of such waste.	NC	NC Pic.08
		(iv) Bio-medical wastes and industrial waste shall not be mixed with municipal solid waste and such wastes shall follow the rules separately specified for the purpose.	Partially Complied	Partially Complied
		(v) Waste (garbage, dry leaves) shall not be burnt	NC	NC
		(vi) Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws.	NC	NC Pic.01 & 11
2.	Segregation of Municipal Solid Waste	In order to encourage the citizens, municipal authority shall organize awareness programmes for segregation of waste and shall promote recycling or reuse of segregated materials.	Partially Complied	Partially Complied
3.	Storage of Municipal Solid Waste	Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and in sanitary conditions around it. Following criteria shall be taken into account while establishing and maintain storage facilities namely:	NC	NC Pic.06
4.	Transportation of Municipal Solid Waste	Vehicle used for transportation of waste shall be covered. Waste should not be visible to public, or exposed to open environment preventing their scattering.	Partially Complied	Partially Complied Pic.07,09 & 10
5.	Processing of Municipal Solid Waste	Municipal authorities shall adopt suitable technology or combination of such technology to make use of wastes so as to minimize burden on landfill i.e. biodegradable waste shall be processed by composting, vermicomposting, anaerobic digestion etc.	Process for composting adopted	Process for tendering
6.	Disposal of Municipal Solid Waste	Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.	NC	NC

Schedule-III

S. No	Specification for Landfill Sites	Bhopal	Indore
1.	Site Selection	Old dumpsites are being used. Not developed as per MSW rule. Recently BMC acquire land for development of new landfill site at Adampur Chhawani on Raisen Road, Bhopal. Pic.03	Old dumpsites are being used. Not developed as per MSW rule
2.	Facilities at the Site	<p>Approach and other internal roads shall exist at the site, but it is not useful in rainy seasons.</p> <p>Utilities such as drinking water (preferably bathing facilities for workers) are provided.</p> <p>The following facilities as per MSW Rule, 2000 are not available at the site:</p> <p>(i) Fenced /boundary wall was not provided at dumpsite, no record was available of incoming loaded vehicles.</p> <p>(ii) Landfill site was not protected to prevent entry of unauthorized persons and stray animals.</p> <p>(iii) The landfill site has no waste inspection facility to monitor wastes brought in for landfill, No office facility for record keeping and shelter for keeping equipment and machinery. Pollution monitoring equipment was not available.</p> <p>(iv) Weigh bridge & fire protection equipment was available but not in working condition.</p> <p>(v) Drink water & bathing facilities were available, but no proper light facilities was provided during dumping in night hours.</p>	<p>Same as Bhopal Site</p> <p>Same as Bhopal Site</p> <p>Same as Bhopal Site</p> <p>Same as Bhopal Site</p> <p>Same as Bhopal Site</p> <p>Same as Bhopal Site</p> <p>(iv) Weigh bridge & fire protection equipment was not available at site.</p> <p>(v) Drink water, bathing & proper light facilities were not available. no such lightening</p>
3.	Specification for land filling	Non Compliance	Non Compliance

4	Pollution Prevention	<p>The following provisions as per MSW Rule, 2000 are not provided:</p> <ul style="list-style-type: none">(i) for diversion of storm water drains(ii) construction of lining system at the base and walls of waste disposal area.(iii) leachate collection & treatment.(iv) protecting run-off from landfill area.(v) Water Quality Parameters: There was no provision for drawing ground water from piezometric holes; hence ground water from nearby area was collected. The parameters such as MPN, total Hardness and Chlorides are exceeds the limits as given in MSW Rule-2000.(vi) Air Quality Data: The values for SPM are exceeds the limits as given in MSW Rule 2000.(vii) No vegetative covers shall be provided at dumpsite.	<p>Same as Bhopal site</p> <p>Air Quality Data: The values for SPM are exceeds the limits as given in MSW Rule 2000.</p> <p>Same as Bhopal site</p>
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Pic.01 Open burning of MSW, Bhanpura site, Bhopal (MP)

000046



Pic.02 Vehicles moving in the Dumpsite at Bhopal



Pic.03 Unrestricted entry of men and animals at Indore dumpsite



Pic.04 Open burning of MSW dumpsite, Indore



Pic.05 Dead animals inside the MSW dumpsite, Indore

000048



Pic.06 Waste thrown open on the street at Indore



Pic.07 Transportation trolley used by IMC, Indore



Pic.08 Children in contact with dead animals at Indore dumpsite



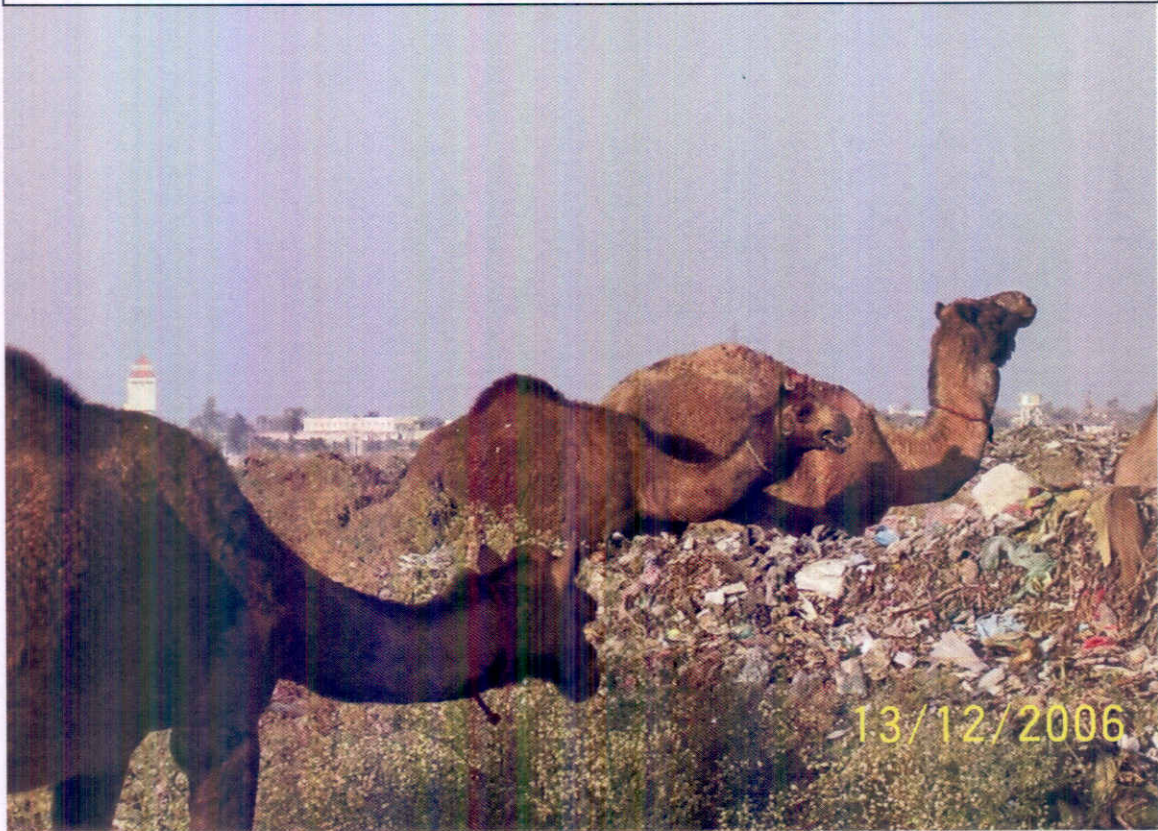
Pic.09 Open trucks used by IMC for MSW handling, Indore



Pic.10 Transportation trolley used by IMC, Indore



Pic.11 Camels & Sheep moving inside the dumpsite, Indore



Pic.12 Refuse collector used by Bhopal Municipal Corporation

